To: Costa, Dan[Costa.Dan@epa.gov]; Gilmour, Ian[Gilmour.Ian@epa.gov]; Machiele, Paul[machiele.paul@epa.gov]
From: Shannon Gustafson
Sent: Mon 1/6/2014 3:31:28 PM
Subject: Letter on Anti-Backsliding Report
ACE Letter to EPA on Backsliding Report.pdf

Good morning,

Please accept the attached letter from Brian Jennings, Executive Vice President of the American Coalition for Ethanol (ACE), regarding the Agency's work on the Section 211(v) "anti-backsliding" report, required by Congress under the 2007 Energy Independence and Security Act.

Brian may be contacted with questions at bjennings@ethanol.org or 605-334-3381 ext. 12.

Sincerely,

Shannon Gustafson

Shannon Gustafson

Director of Strategic Projects

American Coalition for Ethanol

605.334.3381 ext. 16

www.ethanol.org

January 6, 2014

The Honorable Gina McCarthy
Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Dear Administrator McCarthy:

On behalf of the nearly 600 members of the American Coalition for Ethanol (ACE), I write today in regards to the Agency's work on the Section 211(v) "anti-backsliding" report, required by Congress under the 2007 Energy Independence and Security Act.

ACE is comprised of farmers, ethanol producers, Main Street businesses, technology firms, engineers, and industry suppliers who have stood shoulder to shoulder to innovate and grow the domestic ethanol industry in communities throughout the U.S.

On the heels of EPA's decision to significantly undermine the structural integrity of the Renewable Fuel Standard (RFS) through a proposed rule to reduce the Renewable Volume Obligations (RVOs) for 2014, we are deeply concerned by the potential for further unjustified criticism of the renewable fuels sector should EPA publicly issue a one-sided Section 211(v) report on the emissions and air quality impacts from ethanol-blended fuels.

We believe that EPA should ensure that analyses related to air quality from transportation fuels be balanced and consider real-world scenarios. Real-world evidence and EPA's own research proves that adding clean octane, such as ethanol, to gasoline reduces harmful tailpipe emissions from motor fuel. Unfortunately, the legislative language requiring the Section 211(v) study doesn't acknowledge this fact, and instead directs EPA to study "different (ethanol) blend levels, types of renewable fuel and available vehicle technologies." Nevertheless, the statute doesn't prohibit EPA from examining the public health and pollution effects of gasoline and increased emissions of toxic polycyclic aromatic hydrocarbons in gasoline. We would expect, as an Agency charged with protecting the environment, EPA will ensure a real-world examination including the impact of these toxic gasoline ingredients.

Furthermore, we are very troubled by the distorted research model (EPAct Phase III) EPA is relying upon to issue this Section 211(v) report. Experts have identified several deficiencies in the assumptions and methodologies used in EPAct. They and we are primarily concerned with EPA's use of so-called "match blending" methodologies (which were facilitated in part by Chevron employees) to evaluate the effect on emissions when ethanol is added to gasoline. In public statements, EPA has warned that the model does not represent real-world gasoline blends, with the statement "Caution: does not work this way for real fuels!"

By using pure 100% gasoline metrics to shape modeling results, the EPAct model ensures that additional ethanol will appear to increase emissions, because as more ethanol is added to gasoline, the modelers also add more toxic aromatics. However, because ethanol is a cleaner and more affordable source of octane, the practical reality is that if the additional ethanol were splash-blended to E10 (the most

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common fuel blend in the U.S. today), adding ethanol would result in fewer aromatic compounds. In other words, the model EPA is using doesn't reflect the fuel consumers are using in vehicles today and is manipulated to guarantee adding ethanol increases emissions, when in reality the opposite is true.

Additionally, since aromatics are the primary source of harmful urban particulate matter, air toxics, and other criteria pollutants, the EPAct model's conclusions (that more ethanol increases emissions) are in fact the exact opposite of what automaker studies have shown. Studies from Ford Motor Company and others indicate that blends of ethanol, such as E30, reduce particulate matter, particulate number, and black carbon emissions.

We believe the EPAct model is so flawed, and the results of the Section 211(v) report will be so distorted, that we are requesting to have ACE members meet with you before EPA issues the report publicly. It is the responsibility of EPA to ensure this report is fair and doesn't further undermine the men and women who are working in American agriculture and clean fuels sectors to supply us with safe and affordable supplies of renewable fuel.

Thank you for your time and attention to this matter.

Sincerely,

Brian Jennings, Executive Vice President
American Coalition for Ethanol

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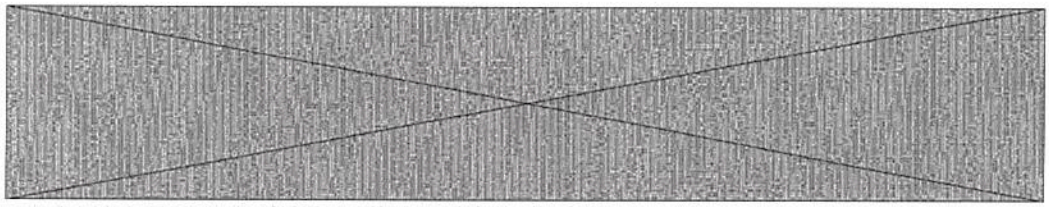
To: Machiele, Paul[machiele.paul@epa.gov]
From: Dawn Moore
Sent: Fri 7/25/2014 2:37:56 PM
Subject: RFA to DOE: Update Your E85 Data!



RFA to DOE: Update Your E85 Data!

(July 25, 2014) WASHINGTON, D.C. — Today, the Renewable Fuels Association (RFA) pointed to the vast underrepresentation of E85 stations in the Department of Energy's (DOE) Alternative Fuels Data Center (AFDC) database and implored DOE to accurately account for all stations selling E85. RFA uncovered nearly 1,000 missing stations as it compared the 2,391 stations found in the database on Tuesday to the 3,349 retail locations found on the "crowd-sourced" website E85prices.com.

"The AFDC database is way off in its reporting of E85 stations, and this is negatively influencing discussions over the 2014 Renewable Fuel Standard (RFS) blending requirements. It isn't just a handful of stations that are missing; we are talking about the exclusion of hundreds of stations nationwide. In fact, they missed 40 percent of the stations that are included in other databases! That's simply unacceptable," said Bob Dinneen, president and CEO of the RFA.

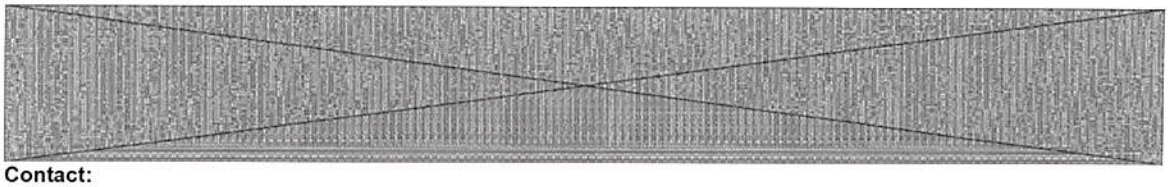
In a letter sent to the DOE's Office of Energy Efficiency & Renewable Energy, the RFA illustrates the central role of the database in crucial policy decisions, stating, "EPA's mistaken belief that existing E85 refueling infrastructure is insufficient to distribute the 2014 RFS volumes specified in the statute is based in large part on information from the AFDC. As a result, the Agency wrongly proposed to reduce required renewable fuel blending volumes in 2014."

Dinneen stressed the urgent need for updated, accurate information as the EPA decides the final 2014 RFS blending requirements. He noted, "Accurate data is the foundation of well informed decisions. The so-called 'blend wall' — the level at which oil companies claim they can no longer blend ethanol into gasoline — can be scaled through increased use of E85. Therefore, an accurate accounting of E85 stations distributing low-cost, renewable fuels is vital to informing the debate over RFS implementation."

The letter concludes, "The correctness and completeness of the database has never been more important, as crucial policy and regulatory decisions are being informed by the information. Inadequate data leads to ill-informed policy decisions, which can have significant consequences for affected industries.

RFA's letter to the Department of Energy can be found here.

Contact:
Dawn Moore



Contact:
Dawn Moore
Communications Director
Renewable Fuels Association
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To: Jung, Zoltan[Jung.Zoltan@epa.gov]; Machiele, Paul[machiele.paul@epa.gov]
From: Scott Fenwick
Sent: Fri 6/20/2014 9:17:42 PM
Subject: FW: EPA Technical Project input
FY2014 Technical Program Plan Descriptions.docx
Technical Summary Activites to EPA May 2014.docx

My apologies, Zoltan. It appears as though Lindsay and I each thought that the other was going to be forwarding this information to you.

I'd be happy to discuss further or answer any additional questions that you might have.

I'll be at the ASTM D02 meetings next week in Indianapolis, but feel free to send me a message.

Scott Fenwick

Technical Director

National Biodiesel Board

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Biodiesel – America's Advanced Biofuel

FY2014 Technical Program Project Details

Fuel Quality Assurance

Fuel quality is the cornerstone for success within the industry. As one of the latest fuel components to reach widespread distribution within the marketplace, biodiesel quality has been subject to scrutiny for a number of years. Early on, consistent quality was suspect as evidenced by reported field issues and fuel quality surveys. Positive identification of poor biodiesel quality has diminished while there has been drastic improvements to the biodiesel and biodiesel blend quality noticed in the field. The last NREL B100 fuel quality survey indicated over 95% of the volume of biodiesel being produced in the US met the D6751 ASTM standards, but the industry is shooting for 100%. As such, it is important to continue to stress the importance of quality assurance and oversight.

The quality assurance project will take proactive steps to promote fuel quality through work with ASTM and advancing and growing the BQ-9000 Quality Management program. This will be accomplished by engaging in fuel quality discussions with industry stakeholders: producers, distributors, state weights and measures, consumers, and OEMs. The importance of fuel quality will be portrayed through the use of news releases and publications. When quality assurance issues arise appropriate measures will be taken to develop tools and training as needed.

The project will include aspects for each of the points within the list of Activities mentioned above in order to support and promote higher blends and more discretionary blending of biodiesel within the fuels marketplace.

Auto and Engine Dealer Education

As biodiesel volumes continue to rise in the U.S. under RFS-2, and as more OEM diesel vehicle brands enter the U.S. marketplace, it is more critical than ever for NBB to continue its push for B20 support from OEMs across the board both in their current diesel vehicles as well as upcoming new models. This is being done through the separate OEM HQ project.

Equally important is the need to communicate that OEM support for B20 to their dealer networks and major customers, equipping them with the tools and information they need in order to feel confident in recommending or using biodiesel blends in their diesel vehicles, and to do so in a proactive and positive manner. If a customer or fleet asks their dealer, 'Can I run B20 in my vehicle', and their dealer tells them 'no' or says disparaging things about biodiesel, all the years of effort and funding to secure B20 approvals goes for nothing.

By reaching out to these groups via articles and advertisements in key automotive dealer trade publications, presenting and exhibiting at major dealer and fleet conferences and meetings, identifying a strong list of biodiesel fleet customers and leveraging their influence with dealers, and providing compelling biodiesel materials at the point-of-sale in the dealerships themselves, NBB can help ensure that dealers are well-equipped to use their company's biodiesel acceptance as a positive selling point in their diesel vehicle sales process and bolster biodiesel's place as a low cost, high quality option for meeting RFS-2 mandated fuel levels.

This project will provide resources to work cooperatively with the internal OEM dealer training centers

and communicate directly with the downstream dealers, and indirectly with their customers and fleets, to ensure they are properly informed about their OEM's position on biodiesel blends and the facts regarding biodiesel blend usage in their engines and vehicles. These downstream dealers represent the front line in the biodiesel education battle, as they communicate directly to customers, fleets and other dealers much more than representatives from the OEM headquarters do. This provides us with the opportunity to leverage the dealers' access to the end-users to communicate positive biodiesel messages.

However, dealers are also a rather hard-to-reach audience, operate largely independently of the company whose vehicles they sell, and tend to default to their traditional "safety net" of known vehicle selling points and service advisories when working with customers. This presents us with an opportunity, however, to leverage the influence that major fleet customers (especially those already using biodiesel) carry with dealers to help urge the dealers' understanding and acceptance of biodiesel blend use in the vehicles they sell.

Therefore, we must use smart tactics and impactful communications mediums to ensure that dealers and fleets are properly equipped with the most current knowledge and positive information resources on biodiesel. By reaching out to these groups via articles and advertisements in key automotive dealer trade publications, presenting and exhibiting at major dealer and fleet conferences and meetings, identifying a strong list of biodiesel fleet customers and leveraging their influence with dealers, and providing compelling biodiesel materials at the point-of-sale in the dealerships themselves, NBB can help ensure that dealers are well-equipped to use their company's biodiesel acceptance as a positive selling point in their diesel vehicle sales process and bolster biodiesel's place as a low cost, high quality option for meeting RFS-2 mandated fuel levels.

Biodiesel Stability in Passenger Cars for B20 OEM Support

Petrodiesel in the U.S. traditionally had adequate stability for normal use (i.e. 6 months) and even for use in low turnover applications such as back-up electrical generator sets or life-boats on large ocean going vessels. As such, there is no current stability specification requirement for petrodiesel within ASTM. The advent of ultra-low sulfur petrodiesel and increasing injection system pressures and tighter tolerances with new High Pressure Common Rail (HPCR) diesel engines in the US has caused the stability of petrodiesel to come into question. This is especially true for today's light duty diesel engines being used in passenger cars. Mercedes requested a working group at ASTM in December 2012 to investigate adding a stability specification for petrodiesel, and the Coordinating Research Council (CRC) is currently conducting efforts on both biodiesel and petrodiesel to determine if fundamental changes to the stability specifications and/or test methods are needed to adequately specify fuels for these relatively new engines.

Stability specifications already exist for B100 in ASTM D6751 (3 hour minimum induction period) and B6-B20 blends in ASTM D7467 (6 hour minimum induction period). A steering committee consisting of NBB, the Truck and Engine Manufacturers Association (EMA), light duty and heavy duty OEM's, and NREL has been formed and is in the process of executing efforts in FY14 that will provide additional data on the adequacy of the current ASTM specifications for B20 and lower with newer HPCR diesel engines. It is anticipated additional efforts will be needed in FY15 to fully address the issue, and this project will

provide cooperative NBB funding toward activities identified by the steering committee as the current efforts become completed.

This project will consist of the NBB Technical Director and key professional consultants leading and coordinating the OEM Steering Committee comprised of NBB, the Truck and Engine Manufacturers Association (EMA), light duty and heavy duty OEM's, NREL and other technical experts that will serve as the guiding force for the efforts to be undertaken to address the concerns being raised by the OEM community. Through detailed discussions and interactions of the OEM Steering Committee, we will identify and document the new issues concerning biodiesel stability and performance in new high pressure common rail engines used in light duty engines that are preventing or hampering B20 support by OEM's. Based on the concerns, we will work with the OEM Steering Committee to develop technical efforts and work scopes that will address the issues identified, select appropriate professional testing or technical firms to execute the work scope, and then manage the execution of the technical efforts being conducted. We anticipate OEM's will be providing significant leverage through the time and effort required to participate on the steering committee and the donation of hardware (engines and/or vehicles) as well as engineering support time for the project.

Once completed, we will make the results available to other NBB program areas for their use, such as the NBB OEM Headquarters efforts, the Auto and Engine Dealer efforts, and the NBB's ASE Biodiesel for Diesel Technicians Training program. This will be in addition to sharing and discussing the results with the OEM Steering Committee. The technical information on stability and performance on B20 in these new engines is part of information needed to encourage movement of formal OEM support from B5 to B20 or higher, and to assist in maintaining existing OEM support for B20 or higher. We will also share the test results with appropriate ASTM and NBB personnel or contractors for potential changes or modifications to stability test methods or ASTM standards for biodiesel or biodiesel blends if the data points to the need for potential changes to the standards.

OEM Headquarters – Securing 90% Approval Level for B20

The OEM HQ program has enabled the NBB to work closely with OEMs to answer questions, disprove myths, and address real and perceived barriers to support of B20 in their equipment. Efforts have been focused on encouraging all OEMs to build B20 support into their engine/vehicle plans so they are in a position to tell customers who are buying new vehicles they are fully approved for B20 or higher blends. NBB focused on heavy duty and medium duty engines/vehicles that use the most diesel fuel *first*, and efforts there have been highly successful. Over 90% of medium and heavy duty manufacturers now support B20 with new equipment coming off the production lines for sale in the U.S. market. As the potential for RFS-2 volumes has increased, the success of the OEM HQ program has been critical in eliminating this major barrier to biodiesel blend sales.

As RFS-2 volumes grow higher and states consider mandates or incentives for blends over B5, the lack of approvals by some light duty OEMs—and lack of clarity on acceptance of blends over B5 in legacy equipment—is hampering the full scale adoption of B20 by some interested users, fleets and states. Thus, as biodiesel volumes continue to rise in the U.S. under RFS-2 and as more OEM diesel vehicle brands enter the U.S. marketplace, it is more critical than ever for NBB to continue its push for B20 support across the board. It is essential that NBB help OEMs recognize the importance of B20 capability,

and encourage them to embrace the concept of B20 biodiesel approval as both an industry need and a marketing tool.

This program will update targeted training programs, conduct strategic planning sessions, and provide technical updates for a consortium of OEM departments to foster greater corporate support for biodiesel among key OEM executives and product development teams. Additional biodiesel support will be garnered through continued networking with other groups such as Clean Cities organizations, the Diesel Technology Forum, auto industry trade associations, and other stakeholder groups. This program will also encourage OEM participation and support for biodiesel at the 2015 National Biodiesel Conference and other key industry events. By encouraging more vocal support for B20 by the OEMs, those messages will then translate to their customer base, in turn generating more public support for and use of biodiesel blends in their vehicles.

Pipeline Biodiesel Steering Committee

The Pipeliner Biodiesel Steering Committee (PBSC) has been instrumental in identifying the technical needs and barriers for movement of biodiesel blends in US multi-product pipelines (MPP's). This project will provide funding to address the technical and regulatory barriers to the transportation of biodiesel blends in US pipelines that have been identified by the PBSC.

Pipeline transport of biodiesel can result in savings of as much as 20 cents per gallon compared to current truck, rail and barge transport, while improving the overall environmental footprint of using biodiesel. This savings will help to solidify biodiesel's role as a cost effective means for refiners and other obligated parties to meet the Renewable Fuel Standard.

NBB formed the Pipeliner Biodiesel Steering Committee (PBSC) in the summer of 2008. This committee is comprised of six members from the largest pipeline companies in the United States (Buckeye, Colonial, Explorer, Magellan, and Epco, Kinder Morgan) and five members from NBB (Steve Howell, Senior Technical Advisor; Bob Metz, Previous NBB Technical Committee Chairman; Mark Tarrien, Green Earth Biofuels; Dave Slade, Renewable Energy Group (REG); Harold Kraus, Kansas Soybean Commission and). The PBSC originally identified the technical and/or regulatory barriers/questions/needs to be addressed in order to facilitate approvals of biodiesel in pipelines in the US.

Many of the issues originally identified have now been addressed. Of paramount importance was a large project to secure data on 400 ppm biodiesel in jet aircraft engines, a project valued at over $2.5MM, which is now complete. The first ballot to approve 100 ppm biodiesel in jet fuel, based on the 400 ppm results will be voted on at the June 2014 ASTM meeting. It is not clear whether the 100 ppm will pass, or whether some lower number like 50 with a ramp up to 100 ppm biodiesel will pass. Regardless of the final outcome, the PBSC members feel confident some higher level than the current allowable 5 ppm will eventually pass at ASTM.

Based on good stewardship of checkoff dollars, the previous planned efforts identified by the PBSC were put on hold pending the outcome of the 400 ppm biodiesel in jet aircraft testing. Now that this outcome is largely positive and ballots are occurring, the PBSC members believe it is now time to address the previously identified efforts which were put on hold. First and foremost is to address any issues or questions that are raised in the 100 ppm ballot process. Other high priority efforts previously

identified include additional pipeline trials to determine accepted practices to maintain the biodiesel at 50 or 100 ppm levels in jet fuel and additional efforts with transmix operators on biodiesel content allowed in transmix. They also include cooperative efforts with the airline trade association (Airlines for America, A4A), the Federal Aviation Administration (FAA), and the American Petroleum Institute (API) to develop the necessary changes to the API and FAA standard practices to accommodate biodiesel blends and sharing this information with airports and the petroleum blenders and distributors supplying airports to insure things are managed properly.

Significant private industry cooperation for these efforts will come in two forms. First, private pipeline (Buckeye, Colonial, Explorer, Epco, Magellan, Kinder Morgan) and biodiesel companies and representatives (Renewable Energy Group, Green Earth Fuels, NBB technical director, NBB Technical Committee Chairman, Kansas Soybean Commission) make up the Pipeliner Biodiesel Steering Committee and provide significant time and expertise to select the high priority efforts and to guide their execution. There will also be significant leveraging with A4A, FAA, and API as the standard practices and guidelines are updated to accommodate biodiesel. Secondly, for pipeline runs and transmix testing there will be significant contributions from biodiesel and petrodiesel companies in terms of providing the fuel and the pipeline shipping costs. Without this support, pipeline trials and transmix testing would not be possible.

Secure B20 Acceptance in Railroad Market

The railroad industry constitutes the third largest market segment for diesel fuel in the United States behind on-road transportation fuel and heating oil. Previous efforts have been successful in securing B5 approvals from each of the major locomotive manufacturers, General Electric (GE) and Electro-Motive Diesel (EMD). While there had been previous initiatives with the railroad industry under other groups, the primary organization with the necessary stakeholders is the Locomotive Maintenance Officers Association, LMOA. Locomotive manufacturers, railroad representatives and other interested parties meet at LMOA meetings to discuss industry issues and collectively determine solutions and paths forward.

The Federal Railroad Association has provided grants in FY13 and FY14 through a contract with Southwest Research Institute to investigate the current fuel supply for today's railroads. Moreover, they are looking at the storage and handling protocols and the impacts these may have on the fuel quality. Moving forward, the NBB's effort is focused on investigating any existing issues with biodiesel use in the commercial rail industry and with gathering the necessary data to promote the consumption of higher blend concentrations.

With new emissions regulations being enacted on the railroad industry, Tier 3 locomotives are just now hitting the market, with Tier 4 engines following soon behind. This project will enable the biodiesel industry to investigate any further material compatibility questions with these newer locomotives. Additionally, biodiesel is becoming a lower cost option within diesel fuel applications, and more distributors are looking to blend higher levels. These volumes, on top of mandates and other strong incentives, are an incentive to partner with a larger railroad to assist with a B20 demonstration project.

ASE Certified Diesel Technician Training

Diesel Technicians and their service managers, who are trained largely from community colleges and professional technical colleges, are often the first point of contact when biodiesel users and consumers have issues or problems. Technicians knowledgeable about all aspects of biodiesel can better provide assistance to consumers when questions are raised. Lack of credible technical information with gasoline technicians/mechanics about ethanol impacts in the gasoline market—and mechanics telling customers not to use ethanol—was a serious issue when ethanol started to grow. The NBB Biodiesel Technician Training program is designed to help prevent this dynamic as biodiesel grows in volume under the RFS (renewable fuel standard) and becomes more of a national commodity.

The technician training program delivers both technical and application information on biodiesel basics and utilization. The core of this training is to equip today's technicians with credible information about this advanced biofuel so biodiesel use is encouraged, not discouraged, as has been the case with other alternative fuels. Diesel Technicians who are well educated about biodiesel will promote its use for their customers; this in turn will help support increased biodiesel use in the market.

Diesel technicians put much more credibility and stock into other mechanics or biodiesel technical experts than they do from those who are viewed as largely just selling or promoting biodiesel. NBB has capitalized on this factor, and utilizes only professional diesel technicians and biodiesel technical experts to provide the diesel technician training. Diesel technicians also desire training to be Automotive Service Excellence (ASE) certified so they can obtain continuing education credits for required professional development as well as feel confident the training is of the utmost in quality and credibility. The NBB Biodiesel Technician Training program was certified by ASE two years ago and is a testament to the technical credibility and the quality of the training.

Many misconceptions about biodiesel exist and troubleshooting mechanical failures can be difficult. This training highlights the benefits of biodiesel and correctly identifies problems caused by ultra-low sulfur diesel (ULSD), raw vegetable oils/fats, out of specification biodiesel, imposter biodiesels, other renewable diesels, and general mechanical issues or ambiguities. Mechanical failures or problems are most often not the result of biodiesel but other issues; however biodiesel is often blamed for these mechanical or performance issues. The Diesel Technician Training program helps alleviate these occurrences with credible information which is presented in a productive learning environment.

BioHeat – Secure Approvals for Legacy Safe to at Least B20

In the fall of 2009, the heating oil industry voted unanimously to approve a sweeping new vision for heating oil in the US that implements both Ultra Low Sulfur Diesel Fuel (ULSD) and Bioheat™ nationwide. NORA anticipates moving to a 'legacy safe' level by 2030 (anticipated to be B20). Heating oil dealers and key Bioheat™ stakeholders like the City of New York have stated lack of an ASTM standard for blends higher than B5 is hampering market penetration of biodiesel blends in the Northeast. NORA and NBB have formed the Bioheat™ Technical Steering Committee (BTSC) which has developed and prioritized the technical efforts needed to achieve this sweeping vision. Current efforts are focused on executing the technical projects needed to secure OEM equipment (burners and boilers) approval for legacy safe

levels. This project will provide FY14 funding toward remaining technical efforts and projects identified by the BTSC in order to develop ballot(s) for the legacy safe level of biodiesel—anticipated to be at least B20—with No. 1 and No. 2 grades in the ASTM D396 heating oil standard.

Test Methods to Identify "Imposter Biodiesel"

State regulators involved with the quality enforcement of fuels are bound by EPA regulations, ASTM specifications and guidelines published by the National Conference of Weights & Measures (NCWM). Contrary to public perception, fuels are not singular cuts of crude oil from a petroleum refinery. Rather, they are blended and mixed solutions of a number of fractions, each with its own characteristics, designed to provide a seasonal fuel that is fit for multi-purposes for a semi-specific geographical location. Over decades, there have been a number of fuel additives developed to both enhance certain properties and/or minimize certain characteristics of these fuels These additives are normally added in very small quantities (a few parts per million in the case of anti-microbial to levels up to 5000 ppm for some cetane enhancers or stability additives) and provide no negative impacts on other bulk fuel properties of interest in diesel applications.

With the growing acceptance of biofuels and other low carbon fuels, more companies have entered the fuels marketplace with new renewable fuels. Some of these new fuels were being blended into petroleum based diesel fuel and claiming the finished blend 'meets the D975 standard' since the physical properties of the finished blend fell within those contained in the D975 standard. Some of these new fuels contained oxygen, and some were predominantly hydrocarbons derived from renewable substances. Some of these renewable fuels are intended as fuel components to be added in the 1-20 percent by volume level, but they are registered with EPA as "fuel additives" not as fuels. This is the case with raw vegetable oil, which contains substantial amounts of oxygen and was registered by some companies many years ago with EPA as a legal fuel additive under the Clean Air Act. Some other oxygenated renewable diesel fuels which have been granted approved EPA RFS2 pathways.

ASTM members recognized that the existing ASTM standards were based largely on the processing of crude petroleum oils into petroleum based diesel fuel through the traditional petroleum refining process. Diesel fuel produced in this way does not contain oxygen, and many of the important properties of fuel for diesel engine operation are pre-set by the conventional crude oils and refining processes used. With this in mind, many of the important properties of diesel fuel such as stability, surface tension, and density are not specified in the ASTM D975 diesel fuel standard because normally produced diesel fuel always had inherently acceptable values for these properties. Likewise, many of the problematic compounds that can be found in renewable feedstock sources—such as partially reacted glycerides, other oxygenated compounds, or phosphorous containing gums—and/or their negative impacts are not tested under the D975 specification.

To address these potential loopholes within D975, ASTM modified D975 to specify fuels falling within D975 must contain only hydrocarbons—or any non-hydrocarbon material must be balloted into the standard at some accepted level through a new "Alternative Fuels and Blend Stocks" section of the standard. A new appendix, X7. GUIDANCE ON EVALUATION OF NEW MATERIALS FOR #1D AND #2D GRADES OF DIESEL FUELS, was also added, which describes the above in more detail.

Biodiesel, which contains 11% by oxygen, was the first such non-hydrocarbon fuel allowed within D975 under the new alternative fuels and blend stocks section, with the level set at 5% maximum and the pre-condition that the biodiesel used for blending meet ASTM D6751, which contains controls for stability and for potential problematic minor components which could be found in biodiesel but aren't normally found (or monitored or specified) in D975 diesel fuel.

Unfortunately, our current ASTM method to determine the biodiesel concentration in diesel fuel cannot differentiate between triglycerides (i.e. raw vegetable oils) and some of their derivatives and biodiesel. It is well known that raw vegetable oils can cause stability issues, filter clogging, and injector coking problems in unmodified diesel engines. The Engine Manufacturers Association has issued a very firm statement to this effect (see "Use of Raw Vegetable/Plant Oil or Animal Fats in Compression-Ignition Engines", http://www.truckandenginemanufacturers.org/articles/search.asp?F_ARTICLE_ID=9). Even though the ASTM standards have now changed to make it clear oxygenated materials like raw vegetable oils no longer fall within the accepted ASTM D975 standard and there are known issues with these materials, some of the companies with existing raw vegetable oil registrations or accepted RFS2 EPA pathways for oxygen containing materials are claiming they are an 'additive' under D975 and are legally EPA registered and therefore still fall within the D975 standard, which is clearly not the intent of the D975 standard.

We have identified several instances in the market where raw vegetable oil was mistaken as biodiesel, either through innocent lack of knowledge or through questionable inferences by the seller, used in an existing diesel engine and caused engine oil sludging and other engine issues. Biodiesel was blamed, and when the existing, accepted test for biodiesel in diesel fuel was run on these samples, (ASTM D7371, and FTIR method) the analysis indicated the fuel contained biodiesel. The D7371 FTIR method detects both triglycerides and biodiesel as biodiesel, and falsely reports all of those compounds as biodiesel. The D7371 procedure was developed knowing the OEM prohibition on the use of raw vegetable oils/fats, so it was assumed any interference or counting of raw vegetable oil in the market would be negligible. This is not turning out to be the case in the current US market.

Therefore, this project will initiate work within ASTM to develop a method that will be able to differentiate between vegetable oils and true biodiesel. The project will be developed and designed by a small task group within ASTM to work on method development, sample preparation of test samples, sample collection and shipping of field samples, and time within the ASTM group to refine and propose new definitions and limits on allowable components within diesel fuel.

On NBB letterhead

Paul Macheille
Official EPA Address

Dear Mr. Machiele,

It was our pleasure to meet with you and Mr. Jung at the EPA Ann Arbor offices on May 7. We hope the technical information and background on the technical status of the biodiesel in the market were of value to EPA. As we mentioned in the meeting, the National Biodiesel Board (NBB) has an extremely active technical department. Over the last 20 years, NBB has invested a significant amount of time and money to address the technical needs and industry demands that were necessary to get the biodiesel industry to the stage of commercial success it now enjoys. NBB is committed to the continued technical investment necessary to grow the biodiesel industry.

We are extremely proud of the accomplishments the NBB Technical Department has amassed over the last 20 years. We have completed EPA Tier 1 and Tier 2 Health Effects Testing and submitted the data to EPA, and biodiesel is now fully registered as both a legal fuel and fuel additive under section 211(b) of the Clean Air Act. We have done the research and testing needed with the OEM and fuels community needed to secure ASTM International consensus standards for pure biodiesel, B100 (ASTM D6751), blends up to 5% by volume with on/off road diesel fuel (ASTM D975) and heating oil (ASTM D396), and for B6-B20 blends with on/off road diesel (ASTM D7467). Over the last 6 years, we have developed the data to secure formal allowance of up to B20 in the D396 heating oil standard and are in the process of balloting its approval at ASTM as well. The cooperative technical efforts of the NBB with the petroleum and OEM communities is often cited as the 'right way' to develop a new fuel as was evidenced in the October 31, 2013 letter from Mercedes Benz to the National Conference on Weights and Measures:

> "The efforts of the biodiesel industry to work with OEMs, fuel refiners and fuel marketers to secure appropriate ASTM specifications serve as a model for other new fuels."

We have conducted significant emissions evaluations, both tailpipe and full life cycle, and have well documented the positive benefits of biodiesel in terms of reduced toxicity, PM, HC, and CO and reduced life cycle carbon emissions. Biodiesel is now the only RFS2 Advanced Biofuel that is available in commercial scale volumes, and growing. These successes do not occur by accident. They are the result of careful planning and prioritization and execution of the research by the best technical experts available.

To this end, each year the NBB brings together the best and brightest technical minds from the engine and vehicle industry, the diesel fuel industry, the additive industry, the biodiesel industry and academia and other technical experts to brainstorm and prioritize the technical needs for increased biodiesel volumes. The NBB members incorporate these prioritized technical needs with other industry commercialization needs such as communication, coordination and government affairs to develop the annual NBB program plan. The NBB program plan serves as the guide for allocation of the funding NBB

receives from its members, government grants and other funders such as the soybean check-off program which has been in the neighborhood of $10MM over the past several years.

In our meeting you requested a summary of the current high priority technical activities NBB is currently focused on, many of which we discussed with you at the meeting. We have attached a copy of the most recent (FY14) NBB Program Plan, which includes the NBB mission, vision, some industry background and general summary paragraphs detailing the overall planed FY14 NBB activities. We have also attached another document containing further details on the technical projects we are currently in the process of conducting for your information.

As we mentioned in our meeting, NBB has spent a tremendous amount of effort to address the questions and technical needs of the engine and vehicle companies so they are able to recommend B20 or higher blends to their customers. This includes continued work on the ASTM standards as diesel fuels and engines/vehicles change over time, the industry's BQ-9000 fuel quality program, and encouraging enforcement of the ASTM specifications by the proper regulatory authorities (i.e. IRS, EPA, NCWM, etc.).

This also includes a tremendous amount of effort on confirming cold weather operation and sharing the proper procedures for storing, blending, and handling of biodiesel and biodiesel blends with the petroleum community. In 2008, we modified the ASTM D6751 B100 specification to include additional controls (the Cold Soak Filtration Test, CSFT) for minor biodiesel components that could potentially cause un-expected filter clogging in cold weather, and in 2011 we added a special appendix on Low Temperature Operability of Biodiesel Blends to the B100 specification. We also modified the D6751 B100 specification to include a special grade of biodiesel—a No. 1-B grade, which set lower cold soak filtration test limits and added controls for mono-glycerides. This No. 1-B grade, which passed in August of 2012, is now an option for use with those diesel fuels sensitive to partially reacted glycerides and for use in colder weather. We are happy to report that over the last two years, with biodiesel volumes the highest on record, the cold flow issues experienced with biodiesel blends across the US were on the same order—if not less than—those of conventional petroleum based diesel fuel. It is this combination of continuous improvement it the specifications and education efforts with those blending, storing and handing biodiesel in the market that has allowed for these superior results.

NBB is committed to continued technical work with the OEM's, the petroleum industry, and with ASTM to ensure biodiesel and biodiesel blends will work in existing and future diesel engines and vehicles just as well—if not better than—conventional petroleum based diesel. We hope this technical information helps to increase the confidence within EPA that the NBB and the biodiesel industry has done our homework on the technical aspects of the use of biodiesel, and that there are no significant technical barriers to higher biodiesel volumes moving into the future.

Sincerely,

Scott Fenwick
Technical Director
National Biodiesel Board

Steve Howell
MARC-IV Consulting, Inc.
Senior Technical Advisor to the NBB

To: Jung, Zoltan[Jung.Zoltan@epa.gov]; Machiele, Paul[machiele.paul@epa.gov]
Cc: Scott Fenwick[sfenwick@biodiesel.org]; showell@marciv.com[showell@marciv.com]; Larry Schafer[lschafer@biodiesel.org]
From: Lindsay Fitzgerald
Sent: Thur 5/8/2014 9:31:36 PM
Subject: Meeting follow up
EPA Ann Arbor Presentation FINAL.PPTX
Meeting with EPA to discuss Technical Issues on May 6 (050614).docx
D975-12a.pdf
IL Data to C Poster 03 07 14.pdf
oem-support-summary---july-2013.pdf
Illinois Mercedes biodiesel brochure_Final.pdf
VW BioDiesel Customer IL 02 2013.pdf
2013_10_31_Mercedes-BenzUSA_Letter_ASTM-D975.pdf
oem-warranty-statement-and-use-of-biodiesel-blends-over-5-(b5).pdf

Zoltan-

Thanks to you and Paul for taking the time to meet with our technical team yesterday. Attached, please find all of the documents we shared during the meeting, we are aware that they may all be posted to the docket.

Scott and Steve will follow up with you and Paul regarding ASTM and NBB Technical meetings. Additionally, they are pulling together some of the technical priorities and related information which they will send to you both.

We look forward to continued dialogue.

If you have questions about any of the documents, please don't hesitate to reach out to us.

Thank you,

Lindsay

Lindsay Fitzgerald

Director, Regulatory Affairs

National Biodiesel Board

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BIODIESEL
America's Advanced Biofuel

May 2014

Biodiesel Technical Update
in Response to Proposed 2014 RVO

Objectives

- Overview of previous, current and potential future Technical Activities of the Biodiesel Industry and the Various Approvals, Support, and Endorsements that Currently Exist
- To provide EPA with the data—and the confidence—needed to encourage higher blends of biodiesel in RFS2 moving forward
  - To understand and agree there are no limitations for biodiesel use in the foreseeable future
  - To understand and agree that there are no cold weather operability issues with biodiesel blends that aren't currently being overcome by the fuels industry

How NBB Technical Operates

- **NBB has a long term commitment to working WITH the petroleum and engine/vehicle industry to address issues, questions, problems, and needs**
  - Over $100MM in technical efforts over last 20 years
- We use reputable, third party entities to complete the technical work needed to address the issues (i.e. SwRI, NREL, Oak Ridge, CRC, Lovelace Respiratory Research Institute, etc.) so it is not questioned
- Executed by industry steering committees comprised of petroleum, OEMs, experts
  - Develop work scopes, execute and review results
  - Gets up front buy in from those that need the information

Cold Temp Operation Misconceptions

- The 2014 RVO NPRM states, "**At the same time, even biodiesel blends as low as B5 cannot be utilized year-round due to cold weather constraints. The cloud point for B5 soy methyl ester (SME) blended with No. 2 diesel is estimated to be approximately 5 °F. Thus, the use of B5 is highly unlikely in any region where temperatures regularly drop below 5 °F.**"
- Five (5) deg. F also happens to be the average Cloud Point temperature of todays ULSD production.

References to Cold Temp Operations in Specifications

- None of the ASTM distillate fuel specifications (D975, D7467, D396, D6751) have limits for any cold-flow properties due to the varying conditions of use and applications for the fuels
- Cold-flow parameters are typically listed to just be reported
  - Cloud Point = Most conservative
  - LTFT = slow cool method designed to correlate to heavy duty performance
  - CFPP = fast cool method designed to correlate to light duty vehicles
  - Pour Point = temperature just above the point at which the fuel no longer "flows"
- Actual limits can be put into place at any point within contractual agreements or by regulatory bodies enforcing fuel quality

References to Cold Temp Operations in Specifications

- Users, and parties to fuel agreements, are specifically informed that, "It is unrealistic to specify low temperature properties that will ensure satisfactory operation at all ambient conditions. In general, cloud point (or wax appearance point) Low Temperature Flow Test, and Cold Filter Plugging Point Test may be used as an estimate of operating temperature limits for Grades No. 1-D S500; No. 2-D S500; and No. 1-D S5000 and No. 2-D S5000 diesel fuel oils. However, satisfactory operation below the cloud point (or wax appearance point) may be achieved depending on equipment design, operating conditions, and the use of flow improver additives as described in X5.1.2. Appropriate low temperature operability properties should be agreed upon between the fuel supplier and purchaser for the intended use and expected ambient temperatures. Test Methods D4539 and D6371 may be especially useful to estimate vehicle low temperature operability limits when flow improvers are used. Due to fuel delivery system, engine design, and test method differences, low temperature operability tests may not provide the same degree of protection in various vehicle operating classes. Tenth percentile minimum air temperatures for U.S. locations are provided in Appendix X5 as a means of estimating expected regional temperatures. The tenth percentile minimum air temperatures can be used to estimate expected regional target temperatures for use with Test Methods D2500, D4539, and D6371. Refer to X5.1.3 for further general guidance on test application.

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Why is This So Important?

- Within the proposed rule (p. 126), it discusses the inability to use "biodiesel blends as low as B5…due to cold weather constrains."
- However, the addition of biodiesel, particularly up to 5% has very little if any impact on the Cloud Point of the fuel which can be different from the operability limit as noted.
- "Conventional low-temperature operability additives can be used with blends, as these are believed to be effective in the petroleum portion of the blend."
- Years of weather data, accumulated knowledge and advice is also provided within the appendices of the relevant ASTM specifications

Why is This So Important?

- "Different No. 2 diesel fuels may have cloud points of -35º to -5ºC (-31o to 23ºF) (some fuels can be higher or lower than these figures)."
- While the blended fuel properties depend upon the individual properties of the components, studies have shown B5 and B20 blends with soy and canola based biodiesels to have minimal impact on the Cloud Point of the blend.
- The diesel fuels received within the last NBB/NREL Cold Flow Study had a Cloud Point of -11 deg. C (12.2 deg. F). The average of several B5's tested was also nearly -11 deg. C
  - If using the tenth-percentile charts to determine operability, then most diesel fuels would not perform in winter weather.

DoE / NREL Biodiesel Blend Studies

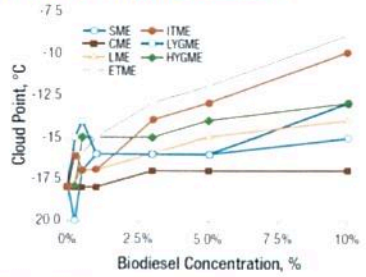


Figure 7. Biodiesel/Diesel Blend Cloud Point Test Results (0%–10% Biodiesel Blend Range)

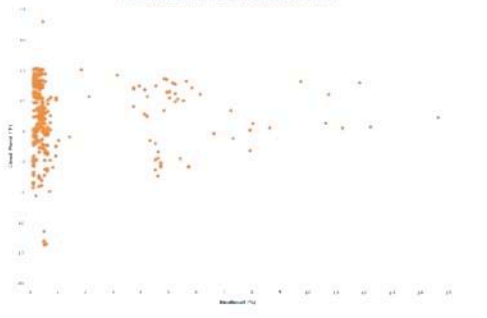
Method Assesments

- ASTM D2500 for Cloud Point (the referee test method) states that the repeatability of the test method for blends of biodiesel in diesel fuel is 2 deg. C. The Reproducibility is 3 deg. C; both of which have just a 95% confidence level.
- "A recent Coordinating Research Council study showed that biodiesel blends (B5 and B20) made from B100 meeting D6751-08a would provide operability down to the cloud point. Additives may allow operation at even lower temperatures."

Field Studies

- As part of a railroad fuel study evaluating actual received lots, BNSF recently tested 256 fuel samples across the U.S. (mostly from Illinois {B11}) to try to correlate Cloud Point to their in-house Cold Soak Filtration test. They found Cloud Point results varying in the data set from -24 to +19 deg F (with the majority of results ranging from -5 to +15 deg. F). When comparing this data set to the tenth percentile maps, the vast majority of these samples would be unsuitable for operability in the northern half of Illinois and higher latitudes.

BNSF Data



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Current Experiences from the Field

- The state of Minnesota is the first example to contradict the statement made that, **"Thus, the use of B5 is highly unlikely in any region where temperatures regularly drop below 5 °F."**
- Illinois is another state in which the incentives for biodiesel use are so strong (B11) that biodiesel blends are used nearly year-round.
- Within these states (and nearly every other) the industry has found ways to provide biodiesel blends to the consumers with the appropriate cold weather operability
  - Blending #1 diesel
  - Cold-flow additives
  - Heated delivery systems

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Biodiesel Approvals and OEM Acceptance

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OEM Warranty Statements

- **All major OEMs selling diesel equipment in the U.S. support at least B5 and lower blends**, provided they are made with biodiesel meeting ASTM D 6751
  - Most OEMs are also recommending use of a BQ-9000 supplier
- **Over 78 percent of U.S. manufacturers (39 brands) support B20** or higher blends in at least some of their equipmen t;
- **Nearly 90 percent of the medium - and heavy-duty truck markets support B20 now, and have for some time**
  - **This is where the majority of the US diesel fuel is used**
- See OEM Summary chart for details by year
- For a complete listing of **OEM position statements on biodiesel**, as well as the **current U.S. Diesel Vehicles List**, visit: www.biodiesel.org/using-biodiesel/oem-information

Blends Higher than the OEM Recommendation Are Being Used

- The biodiesel industry has a long history of working with customers and OEMs on blend levels over that formally recommended by the OEM
  - B20 in EPACT Fleets, School Bus Fleets, and Municipal Bus Fleets in the mid 1990s
- When customers desire blends higher than current recommendations, OEMs support higher blends
  - Underground Mines: B100 use is common
  - Mercedes, VW in Illinois, B11 has over 50% penetration:
    - Letters from VW, Mercedes to Illinois customers saying higher blends can be used

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NBB Committed to formal B20 Support across the board

- Current and Future Efforts to Maintain and/or Increase Formal Biodiesel Support With All Stakeholders
  - Engine/Vehicle Efforts for Across the Board B20 Support (OEM project with Passenger Cars in Progress)
  - Jet Fuel Pipeline Approvals
  - B20 Heating Oil Standards

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Impact of Biodiesel Blends in Existing Engines

- Early (mid 1990's) biodiesel market was urban buses, due to PM reductions required by EPA's retrofit/rebuild program.
  - B20 could provide 25% reduction in visible smoke
- OEMs requested ASTM standards in order to consider more across the board support for biodiesel blends, circa mid 1990's
  - We need an agreed to quality specification in order to support biodiesel
- ASTM Biodiesel Task Force has been in operation since 1993.
- SIGNIFICANT technical data to address questions and issues raised by the OEM community regarding biodiesel blends

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Why B20 is OK in Older Engines

- B20 Fleet Evaluation Team: Develop fact based recommendations for users on the impacts of B20
  - See B20 Fleet Evaluation Team Summary agreed to by all participants, 2005 (handout)
- Potential problems identified by the OEMs are taken care of by the ASTM Biodiesel specifications and research that has been done on elastomers (CRC), engine oil impacts pre in-cylinder post injection (NBB/EMA), water content (EMA survey), etc.
- Improvements to the spec were made as diesel fuel changed (i.e. ULSD introduction) and as engines changed (i.e. DOC/PM traps, SCR)
- Emphasis on meeting the specifications
  - Many previous problems were out of spec biodiesel or other non-biodiesel products (i.e. raw vegetable oil, emulsions, etc.)
  - Biodiesel was being falsely blamed, and NBB is working with OEMs to correct this (see Mercedes Letter to NCWM)

Biodiesel Standards: Efforts Since 1993

ASTM D6751 is the approved standard for B100 for blending, in effect since 2001

D975 – Covers petrodiesel, and blends up to 5% biodiesel maximum for on/off road engines, **B5 in effect since 2008**

D396 – Covers petrodiesel, and blends up to 5% biodiesel maximum for heating oil applications, **B5 in effect since 2008**

- Current ballot to increase the allowable limit up to B20

D7467 – Covers blends containing 6% to 20% biodiesel for on/off road engines, **B6-B20 in effect since 2008**

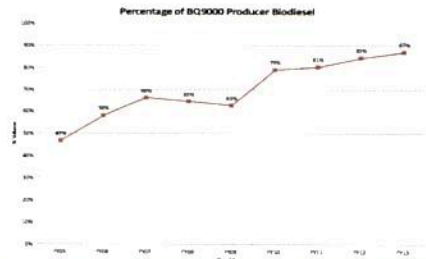
- Designed so that if B100 meets D6751 and petro diesel meets D975, then B6 to B20 blends will meet their specifications
- Most important quality control is at parent fuel level

2013 NREL Fuel Quality Survey

- Over 87% of biodiesel in the market produced by BQ-9000 approved companies
- Samples from 53 producers and 14 terminals were collected
- Critical properties were tested (free/total glycerin, metals, oxidation stability, acid value, etc.)
- More than 95% of all the samples collected met the specification limits

BQ-9000 Certified

The latest numbers show that over 87% of biodiesel produced is by BQ-9000 accredited companies.



Additional Fuel Quality Controls: NBB Fuel Quality Policy Since 2006

- Encourage Regulators (IRS, EPA, NCWM) to Enforce Specifications
- States that have adopted ASTM D6751
  - 2007: 27
  - 2013: 48 (AK and NJ remain)
- States with proactive enforcement
  - 2007: 7
  - 2013: 23

B100 and Biodiesel Blends do not "Void the OEM Warranty"

- Pure biodiesel (B100) is registered as a legal fuel and fuel additive in the US under the 1990 Clean Air Act Amendments, Section 211(b)
  - Supplied EPA with both Tier 1 *and* Tier 2 Health Effects
  - There has been no substantially similar rule for diesel fuel as it pertains to emissions compliance
  - OEMs certify on EPA reference diesel fuel for emissions, not biodiesel/blends
  - Emissions impacts of biodiesel have been well studied and are largely positive
  - Any questions about NOx are solved with new SCR systems with B20 and lower blends
- Use of B100 or biodiesel blends in existing diesel engines does not void the OEM warranty for emissions

NDNO 112.3

B100 and Biodiesel Blends do not "Void the OEM Warranty"

- OEMs warranty the parts and workmanship of their engines, not the fuel used in the engine
  - Magnuson-Moss Warranty Act
- Use of biodiesel meeting ASTM specs, in and of itself, does not void an OEM parts and workmanship warranty
  - If there are problems caused by the fuel—petrodiesel or biodiesel—those are not engine defects and ARE NOT covered by the OEM warranty for any fuel
    - i.e. fuel filter clogging because of fuel contaminants
- OEM warranties are normally only 3-5 years
  - So…main question a user has to ask, "Will using a biodiesel blend cause a problem in my engine different than 'normal' diesel problems?"

Thank You! Questions…?

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NBB Meeting with EPA

1. **Introduction to Technical Team**
2. **Cold Weather**
3. **Warranties**

Technical Team

Steve Howell, Senior Technical Advisor
Scott Fenwick, Technical Director
Jennifer Weaver, OEM Outreach and Education Specialist

Cold Weather

NPRM: "At the same time, even biodiesel blends as low as B5 cannot be utilized year-round due to cold weather constraints. The cold point for B5 soy methyl ester (SME) blended with No. 2 diesel is estimated to be approximately 5F. Thus, the use of B5 is highly unlikely in any region where temperatures regularly drop below 5F. ***Assuming that biodiesel cannot be blended in such regions during any month where the 10% percentile temperature falls below 5F*** *would result in a reduction of the 2014 biomass-based diesel volume by only about 3%. This would still permit more than 2 bill gal of biodiesel to be consumed in 2014. Thus, it appears that for 2014, the ability to consume biodiesel in the vehicle fleet is not constrained by cold weather."*

Preferred Language: Historically, a number of commentators have commented on using biodiesel in cold weather. It is important to note the Cloud Point for both #2 diesel fuel and B5 SME is approximately 5 degree Fahrenheit. Which means that both petroleum diesel and biodiesel have nearly identical cloud points and in severely cold weather *both* must be treated with additives. To address this issue in the marketplace NBB has worked to ensure the quality of biodiesel used, convening a Cold Flow Consortium to consider the best means of using biodiesel in cold weather. Biodiesel can be blended in these areas with a few simple tips in mind, including blend levels up to B20.[1] Even petroleum diesel fuel, with the same cloud point as biodiesel, can have problems in cold weather, and, thus, there is no need to consider whether biodiesel can or can't be used year round all over the country. It can.

Some of the largest biodiesel facilities are in the Northwest and Midwest where temperatures can drop significantly, and production remains year round. These plants, for example, have been able to find feedstocks that provide added cold weather benefits, such as canola in Washington and North Dakota. Canola (CME) has an improved Cloud Point over Soy and has been demonstrated to achieve a Cold Flow Plugging Point (CFPP) of down to -20 °C as B100.

Amongst many examples, Harvard University's diesel fleet, which includes snow plows, operates on biodiesel year round, using B20; the city of New York operates its entire diesel fleet on B5 and is looking to upgrade to B20 by 2016; and Yellowstone National Park currently operates about 300 vehicles, boilers and other diesel equipment on B20. *See, e.g.,* NBB Brochure, *Biodiesel Stands Up to the Cold*, http://www.biodiesel.org/docs/default-source/ffs-performace_usage/biodiesel-stands-up-to-the-cold.pdf?sfvrsn=4. Minnesota, one of the coldest states, currently has a B5 mandate year-round and is

[1] NBB has developed and published a number of guides and studies to inform and help blenders, distributors, users and consumers of biodiesel and biodiesel blends, including with respect to addressing cold weather.

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moving towards increasing the mandate to B10. Illinois, while not a mandated state, has a state tax policy in place that incentivizes biodiesel blends greater than 10%. During times when the pricing of biodiesel is lower than conventional petroleum diesel fuel, the blending increases up to 20% across most of the state. These same B11 and B20 blends have been used this winter and demonstrated their abilities.

Warranties

NPRM:

"most diesel engines are warrantied by their manufacturer to B5. That is, the use of biodiesel in concentrations above 5vol% will void these warranties."

"very few engine models are warrantied by manufacturers to consume B20 have been sold in the U.S. As such, this volume of biodiesel was assumed to be negligible for purposes of this estimate" (footnote 67)

Preferred Language: The steady growth of biodiesel use has allowed blending and distribution infrastructure to increase at a steady pace to meet these demands. *See, e.g.,* Testimony of Michael Whitney, EPA Hearing, EPA-HQ-OAR-2013-0479-0738 at 255.[2] Incremental increases result in reduced costs, and benefits will continue to outpace costs. *See* 77 Fed. Reg. at 59,483. "Advanced biofuels continue to scale, and provide significant economic and environmental opportunities to replace our fossil fuels with renewable alternatives." E2 2013 Advanced Biofuel Report at 17.

Biodiesel can legally be used in transportation fuel at any blend level, including B100. 77 Fed. Reg. at 59,466; *see also* S. Rep. No. 110-65 at 2 ("[E]xisting diesel engines can run on biodiesel in any concentration."). There is near unanimous acceptance that B5 is fungible with diesel fuel. While most use is at a B5 or below level, local and regional markets often use higher blends because biodiesel is currently being sold at a lower price than diesel fuel. Biodiesel is increasingly being used as heating oil as well.

In December of 2001, ASTM approved the full standard for biodiesel, with the new designation of D-6751. This standard covers pure biodiesel (B100) for blending with petrodiesel in levels up to 20% by volume, and allows for higher levels. The approval of this biodiesel standard, and the technical reviews necessary to secure its approval, has provided both the engine community and customers with the information needed to assure trouble free operation with biodiesel blends. Indeed, the current ASTM standards and Federal Trade Commission regulations allow B5 blends to be sold to consumers without disclosure. In other words, the overall supply of distillates (including heating oil) can be blended at B4.999% without violating any approvals or public acceptance by any original equipment manufacturer.

"All major OEMs producing diesel vehicles for the U.S. market support at least B5 and lower blends, and

[2] Several terminals have reopened or announced expansions and new terminals opened in response to the 2013 biomass-based diesel volume and New York heating oil mandates. *See, e.g.,* Gulf Hydrocarbon, *North Houston terminal to reopen for 24/7 biodiesel distribution,* Biodiesel Magazine (Feb. 11, 2013), http://biodieselmagazine.com/articles/8941/north-houston-terminal-to-reopen-for-24-7-biodiesel-distribution; Westmore Fuel Co., *Westmore Biodiesel Grand Opening,* http://www.westmorefuel.com/biodiesel-grand-opening.htm (last visited Jan. 27, 2014); Iowa Biodiesel Board, *Magellan Pipeline adds biodiesel infrastructure to major fuel hub,* Biodiesel Magazine (Sept. 14, 2012), http://biodieselmagazine.com/articles/8700/magellan-pipeline-adds-biodiesel-infrastructure-to-major-fuel-hub.

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over 78% of those manufacturers now support B20 or higher biodiesel blends in at least some of their equipment, including nearly 85% of the medium and heavy duty truck OEMs.[3] The biodiesel component must meet ASTM D6751 and the B20 blends must meet ASTM D7467 specifications.

Some have asked the question whether an engine manufacturer will void its parts and workmanship warranty when biodiesel is used, and most major engine companies have stated formally that the use of blends up to B20 will not void their parts and workmanship warranties. For example, Caterpillar, one of the largest OEMs, states the following in their Caterpillar On-Highway Diesel Engine Fluids Recommendations (at 44), Nov. 2009: "In order to align Caterpillar recommendations with the latest revision of 'ASTM D7467' specification for B6-B20 blends and to ensure that biodiesel fuel meets defined quality standards, Caterpillar recommendations for acceptable biodiesel blend for most engines have been changed to B20." (available at http://parts.cat.com/cda/files/3244668/7/SEBU6385-08%20secure.pdf).

There are 44 new clean diesel car, truck and SUV models available now or launching in the 2014 model year.[4] Additionally, there are more than 27 other automotive brands supplying numerous diesel engines and over 115 different diesel models for the Medium- and Heavy-Duty truck, bus and RV markets. In fact, there are applications requiring diesel fuel that use B100 as a replacement in every opportunity. Underground mining, with all of its heavy-duty equipment and off-road vehicles, use B100 in order to meet their strict underground air quality requirements set forth by the Mining Safety and Health Administration.[5] Caterpillar Tractor Company works closely with these companies and their use of Caterpillar equipment to ensure that higher blends of biodiesel consumption will work, up to B100. Many major fleets and users—such as school buses, municipal buses, and government fleets—have used B20 without incidence since the mid 1990's. Diesel engine companies that supply much of the market where B20 is used, such as Cummins and Caterpillar, have been supporting B20 for over 10 years.[6]

With biodiesel that meets the D-6751 specification, there have been over 45 million miles of successful, problem-free, real-world operation with B20 blends in a wide variety of engines, climates, and applications. The steps taken by the biodiesel industry to work with the engine companies and to ensure that fuel meets the newly accepted ASTM standards provides confidence to users and engine manufacturers that their biodiesel experiences will be positive and trouble-free.

[3] *See, e.g.,* NBB, *OEM Support* (Dec. 2013), *available at* http://www.biodiesel.org/using-biodiesel/oem-information (Attachment 6). BQ-9000 certification provides additional assurance to customers, as well as engine manufacturers, that the biodiesel marketed by these companies meets the ASTM standards for biodiesel and that the fuel supplier will stand behind its products.

[4] NBB Vehicle List 2014, *available at* http://www.biodiesel.org/using-biodiesel/oem-information (Attachment 6).

[5] *See generally* NBB, *Mining*, http://www.biodiesel.org/using-biodiesel/market-segments/mining (last visited Jan. 28, 2014).

[6] NBB, *OEM Support* (Dec. 2013), *available at* http://www.biodiesel.org/using-biodiesel/oem-information (Attachment 6).

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Designation: D975 - 12a

Standard Specification for Diesel Fuel Oils[1]

This standard is issued under the fixed designation D975; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope*

1.1 This specification covers seven grades of diesel fuel oils suitable for various types of diesel engines. These grades are described as follows:

1.1.1 *Grade No. 1-D S15*—A special-purpose, light middle distillate fuel for use in diesel engine applications requiring a fuel with 15 ppm sulfur (maximum) and higher volatility than that provided by Grade No. 2-D S15 fuel.[2]

1.1.2 *Grade No. 1-D S500*—A special-purpose, light middle distillate fuel for use in diesel engine applications requiring a fuel with 500 ppm sulfur (maximum) and higher volatility than that provided by Grade No. 2-D S500 fuel.[2]

1.1.3 *Grade No. 1-D S5000*—A special-purpose, light middle distillate fuel for use in diesel engine applications requiring a fuel with 5000 ppm sulfur (maximum) and higher volatility than that provided by Grade No. 2-D S5000 fuels.

1.1.4 *Grade No. 2-D S15*—A general purpose, middle distillate fuel for use in diesel engine applications requiring a fuel with 15 ppm sulfur (maximum). It is especially suitable for use in applications with conditions of varying speed and load.[2]

1.1.5 *Grade No. 2-D S500*—A general-purpose, middle distillate fuel for use in diesel engine applications requiring a fuel with 500 ppm sulfur (maximum). It is especially suitable for use in applications with conditions of varying speed and load.[2]

1.1.6 *Grade No. 2-D S5000*—A general-purpose, middle distillate fuel for use in diesel engine applications requiring a fuel with 5000 ppm sulfur (maximum), especially in conditions of varying speed and load.

1.1.7 *Grade No. 4-D*—A heavy distillate fuel, or a blend of distillate and residual oil, for use in low- and medium-speed diesel engines in applications involving predominantly constant speed and load.

NOTE 1—A more detailed description of the grades of diesel fuel oils is given in X1.2.

NOTE 2—The Sxxx designation has been adopted to distinguish grades by sulfur rather than using words such as "Low Sulfur" as previously because the number of sulfur grades is growing and the word descriptions were thought to be not precise. S5000 grades correspond to the so-called "regular" sulfur grades, the previous No. 1-D and No. 2-D. S500 grades correspond to the previous "Low Sulfur" grades. S15 grades were not in the previous grade system and are commonly referred to as "Ultra-Low Sulfur" grades or ULSD.

1.2 This specification, unless otherwise provided by agreement between the purchaser and the supplier, prescribes the required properties of diesel fuels at the time and place of delivery.

1.2.1 Nothing in this specification shall preclude observance of federal, state, or local regulations which can be more restrictive.

NOTE 3—The generation and dissipation of static electricity can create problems in the handling of distillate diesel fuel oils. For more information on the subject, see Guide D4865.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

2. Referenced Documents

2.1 *ASTM Standards*:[3]

D56 Test Method for Flash Point by Tag Closed Cup Tester

D86 Test Method for Distillation of Petroleum Products at Atmospheric Pressure

D93 Test Methods for Flash Point by Pensky-Martens Closed Cup Tester

D129 Test Method for Sulfur in Petroleum Products (General High Pressure Decomposition Device Method)

D130 Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test

[1] This specification is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.E0 on Burner, Diesel, Non-Aviation Gas Turbine, and Marine Fuels.

Current edition approved Nov. 1, 2012. Published December 2012. Originally approved in 1948. Last previous edition approved in 2012 as D975–12. DOI: 10.1520/D0975-12A.

[2] This fuel complies with 40 CFR Part 80—Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engines and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements: Final Rule. Regulation of Fuels and Fuel Additives: Fuel Quality Regulations for Highway Diesel Fuel Sold in 1993 and Later Calendar Years.

[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

***A Summary of Changes section appears at the end of this standard**

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D445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)
D482 Test Method for Ash from Petroleum Products
D524 Test Method for Ramsbottom Carbon Residue of Petroleum Products
D613 Test Method for Cetane Number of Diesel Fuel Oil
D1266 Test Method for Sulfur in Petroleum Products (Lamp Method)
D1319 Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption
D1552 Test Method for Sulfur in Petroleum Products (High-Temperature Method)
D1796 Test Method for Water and Sediment in Fuel Oils by the Centrifuge Method (Laboratory Procedure)
D2274 Test Method for Oxidation Stability of Distillate Fuel Oil (Accelerated Method)
D2500 Test Method for Cloud Point of Petroleum Products
D2622 Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-ray Fluorescence Spectrometry
D2624 Test Methods for Electrical Conductivity of Aviation and Distillate Fuels
D2709 Test Method for Water and Sediment in Middle Distillate Fuels by Centrifuge
D2880 Specification for Gas Turbine Fuel Oils
D2887 Test Method for Boiling Range Distribution of Petroleum Fractions by Gas Chromatography
D3117 Test Method for Wax Appearance Point of Distillate Fuels (Withdrawn 2010)[4]
D3120 Test Method for Trace Quantities of Sulfur in Light Liquid Petroleum Hydrocarbons by Oxidative Microcoulometry
D3828 Test Methods for Flash Point by Small Scale Closed Cup Tester
D4057 Practice for Manual Sampling of Petroleum and Petroleum Products
D4177 Practice for Automatic Sampling of Petroleum and Petroleum Products
D4294 Test Method for Sulfur in Petroleum and Petroleum Products by Energy Dispersive X-ray Fluorescence Spectrometry
D4306 Practice for Aviation Fuel Sample Containers for Tests Affected by Trace Contamination
D4308 Test Method for Electrical Conductivity of Liquid Hydrocarbons by Precision Meter
D4539 Test Method for Filterability of Diesel Fuels by Low-Temperature Flow Test (LTFT)
D4737 Test Method for Calculated Cetane Index by Four Variable Equation
D4865 Guide for Generation and Dissipation of Static Electricity in Petroleum Fuel Systems
D5304 Test Method for Assessing Middle Distillate Fuel Storage Stability by Oxygen Overpressure
D5453 Test Method for Determination of Total Sulfur in Light Hydrocarbons, Spark Ignition Engine Fuel, Diesel Engine Fuel, and Engine Oil by Ultraviolet Fluorescence
D5771 Test Method for Cloud Point of Petroleum Products (Optical Detection Stepped Cooling Method)
D5772 Test Method for Cloud Point of Petroleum Products (Linear Cooling Rate Method)
D5773 Test Method for Cloud Point of Petroleum Products (Constant Cooling Rate Method)
D5842 Practice for Sampling and Handling of Fuels for Volatility Measurement
D5854 Practice for Mixing and Handling of Liquid Samples of Petroleum and Petroleum Products
D6078 Test Method for Evaluating Lubricity of Diesel Fuels by the Scuffing Load Ball-on-Cylinder Lubricity Evaluator (SLBOCLE)
D6079 Test Method for Evaluating Lubricity of Diesel Fuels by the High-Frequency Reciprocating Rig (HFRR)
D6217 Test Method for Particulate Contamination in Middle Distillate Fuels by Laboratory Filtration
D6371 Test Method for Cold Filter Plugging Point of Diesel and Heating Fuels
D6468 Test Method for High Temperature Stability of Middle Distillate Fuels
D6469 Guide for Microbial Contamination in Fuels and Fuel Systems
D6751 Specification for Biodiesel Fuel Blend Stock (B100) for Middle Distillate Fuels
D6890 Test Method for Determination of Ignition Delay and Derived Cetane Number (DCN) of Diesel Fuel Oils by Combustion in a Constant Volume Chamber
D6898 Test Method for Evaluating Diesel Fuel Lubricity by an Injection Pump Rig
D7039 Test Method for Sulfur in Gasoline and Diesel Fuel by Monochromatic Wavelength Dispersive X-ray Fluorescence Spectrometry
D7170 Test Method for Determination of Derived Cetane Number (DCN) of Diesel Fuel Oils—Fixed Range Injection Period, Constant Volume Combustion Chamber Method
D7345 Test Method for Distillation of Petroleum Products at Atmospheric Pressure (Micro Distillation Method)
D7371 Test Method for Determination of Biodiesel (Fatty Acid Methyl Esters) Content in Diesel Fuel Oil Using Mid Infrared Spectroscopy (FTIR-ATR-PLS Method)
D7467 Specification for Diesel Fuel Oil, Biodiesel Blend (B6 to B20)
D7619 Test Method for Sizing and Counting Particles in Light and Middle Distillate Fuels, by Automatic Particle Counter
D7688 Test Method for Evaluating Lubricity of Diesel Fuels by the High-Frequency Reciprocating Rig (HFRR) by Visual Observation
E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

2.2 *Other Documents:*

26 CFR Part 48 Manufacturers and Realtors Excise Taxes[5]
40 CFR Part 80 Regulation of Fuels and Fuel Additives[5]

[4] The last approved version of this historical standard is referenced on www.astm.org.

[5] Available from U.S. Government Printing Office, Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401.

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API RP 2003 Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents[6]

EN 14078 Liquid petroleum products - Determination of fatty acid methyl esters (FAME) in middle distillates - Infrared spectroscopy method[7]

3. Terminology

3.1 *Definitions:*

3.1.1 *biodiesel, n*—fuel comprised of mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats, designated B100.

3.1.2 *biodiesel blend (BXX), n*—blend of biodiesel fuel with diesel fuel oils.

3.1.2.1 *Discussion*—In the abbreviation, BXX, the XX represents the volume percentage of biodiesel fuel in the blend.

3.1.3 *switch loading, n—of liquid fuels*, the practice of loading low vapor pressure product (for example, diesel fuel) into an empty or near-empty fixed or portable container that previously held a high or intermediate vapor pressure product (such as gasoline or solvent) without prior compartment cleaning treatment and inert gas purging; and the reverse procedure where a high vapor pressure product is added to a container that previously held a low vapor pressure product.

3.1.3.1 *Discussion*—Since middle distillate fuels have flash points above 38°C, during normal distribution of these fuels, the atmosphere above the fuels in a container such as a tanker truck, rail car, or barge, is normally below the lower explosive limit, so there is low risk of fire or explosion should an electrostatic discharge (spark) occur. However, when the previous load in the compartment was a volatile, flammable fuel such as gasoline, and if some residual fuel vapor or mist remains in the compartment, and the container has a mixture of air and fuel vapor or mist (that is, not purged with an inert gas), then there is a risk that the atmosphere in the container being filled could be in the explosive range creating a hazard should an electrostatic discharge occur.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *hydrocarbon oil, n*—homogeneous mixture or solution with elemental composition primarily of carbon and hydrogen and also containing sulfur, oxygen or nitrogen from residual impurities and contaminants and excluding added oxygenated materials. (See Note 5.)

3.2.1.1 *Discussion*—Neither macro nor micro emulsions are included in this definition since neither are homogeneous mixtures or solutions.

3.2.1.2 *Discussion*—Examples of excluded oxygenated materials are alcohols, esters, ethers and triglycerides.

3.2.2 *S(numerical specification maximum)*—indicates the maximum sulfur content, in weight ppm (μg/g), allowed by this specification in a diesel fuel grade.

3.2.2.1 *Discussion*—Of the seven diesel fuel grades specified in this standard, six have important distinguishing maximum sulfur regulatory requirements. These are Grades No. 1-D S15, No. 1-D S500, No. 1-D S5000, No. 2-D S15, No. 2-D S500 and No. 2-D S5000. The seventh grade, No. 4-D, is distinguished from these other grades by many major properties in addition to sulfur (unregulated maximum), and therefore is not included in this designation system. Thus, Grade No. 4-D does not have the designation S20000 as part of its grade name.

4. Sampling, Containers, and Sample Handling

4.1 It is strongly advised to review all test methods prior to sampling to understand the importance and effects of sampling technique, proper containers, and special handling required for each test method.

4.2 Correct sampling procedures are critical to obtaining a representative sample of the diesel fuel oil to be tested. Refer to Appendix X2 for recommendations. The recommended procedures or practices provide techniques useful in the proper sampling or handling of diesel fuels.

5. Test Methods

5.1 The requirements enumerated in this specification shall be determined in accordance with the following methods:

5.1.1 *Flash Point*—Test Methods D93, except where other methods are prescribed by law. For all grades, Test Method D3828 may be used as an alternate with the same limits. For Grades No. 1-D S15, No. 1-D S500 , No. 1-D S5000, No. 2-D S15, No. 2-D S500, and No. 2-D S5000, Test Method D56 may be used as an alternate with the same limits, provided the flash point is below 93°C and the viscosity is below 5.5 mm^2 /s at 40°C. This test method will give slightly lower values. In cases of dispute, Test Methods D93 shall be used as the referee method. Test Method D56 may not be used as the alternate method for Grade No. 4-D because its minimum viscosity limit is 5.5 mm^2/s at 40°C.

5.1.2 *Cloud Point*—Test Method D2500. For all fuel grades in Table 1, the automatic Test Methods D5771, D5772, or D5773 can be used as alternates with the same limits. Test Method D3117 can also be used since it is closely related to Test Method D2500. In case of dispute, Test Method D2500 shall be the referee method.

5.1.3 *Water and Sediment*—Test Method D2709 is used for fuel Grades No. 1-D S15, No. 1-D S500, No. 1-D S5000, No. 2-D S15, No. 2-D S500, and No. 2-D S5000. Test Method D1796 is used for Grade No. 4-D.

5.1.4 *Carbon Residue*—Test Method D524 is used for fuel Grades No. 1-D S15, No. 1-D S500, No. 1-D S5000, No. 2-D S15, No. 2-D S500 and No. 2-D S5000. Grade No. 4-D does not have a limit for carbon residue.

5.1.5 *Ash*—Test Method D482 is used for all grades in Table 1.

5.1.6 *Distillation*—Test Method D86 is used for Grades No. 1-D S15, No. 1-D S500, No. 1-D S5000, No. 2-D S15, No. 2-D S500, and No. 2-D S5000. For all grades, Test Method D2887 or Test Method D7345 can be used as an alternate. Results from Test Method D2887 shall be reported as "Predicted D86" results by application of the correlation in Appendix X5 of Test Method D2887 to convert the values. Results from Test Method D7345 shall be reported as "Predicted D86" results by

[6] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

[7] Available from the National CEN members listed on the CEN website (www.cenorm.be) or from the CEN/TC 19 Secretariat (astm.@nen.nl).

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TABLE 1 Detailed Requirements for Diesel Fuel Oils[A,B]

Property	ASTM Test Method[C]	Grade						
		No. 1-D S15	No. 1-D S500[D]	No. 1-D S5000[E]	No. 2-D S15[F]	No. 2-D S500[D,F]	No. 2-D S5000[E,F]	No. 4-D[F]
Flash Point, °C, min.	D93	38	38	38	52[F]	52[F]	52[F]	55
Water and Sediment, % vol, max	D2709	0.05	0.05	0.05	0.05	0.05	0.05	...
Distillation Temperature, °C90 %, % vol recovered	D1796	...	...	...	...	...	...	0.50
min	D86	...	...	...	282[F]	282[F]	282[F]	...
max		288	288	288	338	338	338	...
Kinematic Viscosity, mm^2/S at 40°C	D445							
min		1.3	1.3	1.3	1.9[F]	1.9[F]	1.9[F]	5.5
max		2.4	2.4	2.4	4.1	4.1	4.1	24.0
Ash % mass, max	D482	0.01	0.01	0.01	0.01	0.01	0.01	0.10
Sulfur, ppm (µg/g)[G] max	D5453	15	...	...	15	...	...	...
% mass, max	D2622[H]	...	0.05	...	...	0.05	...	...
% mass, max	D129	...	...	0.50	...	...	0.50	2.00
Copper strip corrosion rating, max (3 h at a minimum control temperature of 50°C)	D130	No. 3	No. 3	No. 3	No. 3	No. 3	No. 3	...
Cetane number, min[I]	D613	40.[J]	40.[J]	40.[J]	40.[J]	40.[J]	40.[J]	30.[J]
One of the following properties must be met:								
(1) Cetane index, min.	D976–80[H]	40	40	...	40	40	...	...
(2) Aromaticity, % vol, max	D1319[H]	35	35	...	35	35	...	...
Operability Requirements								
Cloud point, °C, max	D2500	[K]	[K]	[K]	[K]	[K]	[K]	...
or								
LTFT/CFPP, °C, max	D4539/D6371							
Ramsbottom carbon residue on 10 % distillation residue, % mass, max	D524	0.15	0.15	0.15	0.35	0.35	0.35	...
Lubricity, HFRR @ 60°C, micron, max	D6079/D7688	520	520	520	520	520	520	...
Conductivity, pS/m or Conductivity Units (C.U.), min	D2624/D4308	25[L]	25[L]	25[L]	25[L]	25[L]	25[L]	...

[A] To meet special operating conditions, modifications of individual limiting requirements may be agreed upon between purchaser, seller, and manufacturer.

[B] See Sections 6 and 7 for further statements on diesel fuel requirements.

[C] The test methods indicated are the approved referee methods. Other acceptable methods are indicated in 5.1.

[D] Under United States regulations, if Grades No. 1–D S500 or No. 2–D S500 are sold for tax exempt purposes then, at or beyond terminal storage tanks, they are required by 26 CFR Part 48 to contain the dye Solvent Red 164 at a concentration spectrally equivalent to 3.9 lb per thousand barrels of the solid dye standard Solvent Red 26, or the tax must be collected.

[E] Under United States regulations, Grades No.1–D S5000, No. 2–D S5000, and No. 4–D are required by 40 CFR Part 80 to contain a sufficient amount of the dye Solvent Red 164 so its presence is visually apparent. At or beyond terminal storage tanks, they are required by 26 CFR Part 48 to contain the dye Solvent Red 164 at a concentration spectrally equivalent to 3.9 lb per thousand barrels of the solid dye standard Solvent Red 26.

[F] When a cloud point less than -12°C is specified, as can occur during cold months, it is permitted and normal blending practice to combine Grades No. 1 and No. 2 to meet the low temperature requirements. In that case, the minimum flash point shall be 38°C, the minimum viscosity at 40°C shall be 1.7 mm^2/s, and the minimum 90 % recovered temperature shall be waived.

[G] Other sulfur limits can apply in selected areas in the United States and in other countries.

[H] These test methods are specified in 40 CFR Part 80.

[I] Where cetane number by Test Method D613 is not available, Test Method D4737 can be used as an approximation. Although biodiesel blends are excluded from the scope of Test Method D4737, the results of Test Method D4737 for up to B5 blends can be used to show compliance with the cetane number requirement of this specification, because Test Method D4737 has been shown to underpredict the cetane number of such blends on average.

[J] Low ambient temperatures as well as engine operation at high altitudes may require the use of fuels with higher cetane ratings.

[K] It is unrealistic to specify low temperature properties that will ensure satisfactory operation at all ambient conditions. In general, cloud point (or wax appearance point) Low Temperature Flow Test, and Cold Filter Plugging Point Test may be used as an estimate of operating temperature limits for Grades No. 1–D S500; No. 2–D S500; and No. 1–D S5000 and No. 2–D S5000 diesel fuel oils. However, satisfactory operation below the cloud point (or wax appearance point) may be achieved depending on equipment design, operating conditions, and the use of flow-improver additives as described in X5.1.2. Appropriate low temperature operability properties should be agreed upon between the fuel supplier and purchaser for the intended use and expected ambient temperatures. Test Methods D4539 and D6371 may be especially useful to estimate vehicle low temperature operability limits when flow improvers are used. Due to fuel delivery system, engine design, and test method differences, low temperature operability tests may not provide the same degree of protection in various vehicle operating classes. Tenth percentile minimum air temperatures for U.S. locations are provided in Appendix X5 as a means of estimating expected regional temperatures. The tenth percentile minimum air temperatures can be used to estimate expected regional target temperatures for use with Test Methods D2500, D4539, and D6371. Refer to X5.1.3 for further general guidance on test application.

[L] The electrical conductivity of the diesel fuel is measured at the time and temperature of the fuel at delivery. The 25 pS/m minimum conductivity requirement applies at all instances of high velocity transfer (7 m/s) but sometimes lower velocities, see 8.1 for detailed requirements) into mobile transport (for example, tanker trucks, rail cars, and barges).

application of the corrections described in Test Method D7345 to convert to D86 equivalent values. In case of dispute, Test Method D86 shall be the referee method. Grade No. 4-D does not have distillation requirements.

5.1.7 *Viscosity*—Test Method D445 is used for all fuel grades in Table 1.

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5.1.8 *Sulfur*—The following list shows the referee test methods and alternate test methods for sulfur, the range over which each test method applies and the corresponding fuel grades.

Sulfur Test Method	Range	Grades
D129 (referee)	>0.1 mass %	No. 1-DS5000, No. 2-D S5000, No. 4-D
D1266	0.0005 to 0.4 mass % 5 to 4000 mg/kg (wt ppm)	No. 1-DS500, No. 2-DS500
D1552	>0.06 mass %	No. 1-D S5000, No. 2-D S5000, No. 4-D
D2622 (referee for S500 Grades)	0.0003 to 5.3 mass % 3 to 53 000 mg/kg (wt ppm)	All Grades
D3120	3.0 to 100 mg/kg (wt ppm)	No. 1-DS15, No. 2-DS15 No. 1-DS500, No. 2-DS500 (S500 grades must be diluted before testing)
D4294	0.0150 to 5.00 mass % 150 to 50 000 mg/kg (wt ppm)	No. 1-D S5000, No. 2-D S5000, No. 4-D
D5453 (referee for S15 grades)	0.0001 to 0.8 mass % 1.0 to 8000 mg/kg (wt ppm)	All Grades
D7039	4 to 17 mg/kg	No. 1–D S15, No. 2–D S15

NOTE 4—The units used to report results in the above test methods are:

D129	mass %
D1266	mass %
D1552	mass %
D2622	mass %
D3120	ppm (μg/g)
D4294	mass %
D5453	ppm (μg/g)
D7039	mg/kg

Results reported in mg/kg and in ppm (μg/g) are numerically the same. The units used in Table 1 for the sulfur requirements are the units in which results for the referee test are reported.

5.1.9 *Copper Corrosion*—Test Method D130, 3-h test at a minimum control temperature of 50°C. This test method is used for fuel Grades No. 1-D S15, No. 1-D S500, No. 1-D S5000, No. 2-D S15, No. 2-D S500 and No. 2-D S5000. Grade No. 4-D does not have a copper corrosion requirement.

5.1.10 *Cetane Number*—Test Method D613 is used for all fuel grades in Table 1. Test Method D6890 or Test Method D7170 may be used for all No. 1-D and No. 2-D grades with the DCN result being compared to the cetane number specification requirement of 40. Test Method D613 shall be the referee method.

5.1.11 *Cetane Index*—Test Methods D976–80 is used for fuel Grades No. 1-D S15, No. 1-D S500, No. 2-D S15 and No. 2-D S500. Grades No. 1-D S5000, No. 2-D S5000 and No. 4-D do not have an aromatics content requirement, so do not use this test method as a surrogate for aromatics content.

5.1.12 *Aromaticity*—Test Method D1319. This test method provides an indication of the aromatics content of fuels. For fuels with a maximum final boiling point of 315°C, this method is a measurement of the aromatic content of the fuel. This test method is used for fuel Grades No. 1-D S15, No. 1-D S500, No. 2-D S15 and No. 2-D S500. Grades No. 1-D S5000, No. 2-D S5000 and No. 4-D do not have an aromatics content requirement.

5.1.13 *Lubricity*—Test Method D6079 or D7688. Test Method D6079 shall be the referee method.

5.1.14 *Conductivity*—Both conductivity test methods, Test Methods D2624 and D4308 are allowed for all grades of No. 1 and No. 2 diesel fuels. There is no conductivity requirement for No. 4 diesel fuel. For conductivities below 1 pS/m, Test Method D4308 is preferred.

6. Workmanship

6.1 The diesel fuel shall be visually free of undissolved water, sediment, and suspended matter.

7. Requirements

7.1 The grades of diesel fuel oils herein specified shall be hydrocarbon oils, except as provided in 7.3, with the addition of chemicals to enhance performance, if required, conforming to the detailed requirements shown in Table 1.

NOTE 5—Additives are generally included in finished diesel fuel to improve performance properties (cetane number, lubricity, cold flow, etc.).

7.2 *Grades No. 2-D S15, No. 2-D S500 and No. 2–D S5000*—When a cloud point less than -12°C is specified, as can occur during cold months, it is permitted and normal blending practice to combine Grades No. 1 and No. 2 to meet the low temperature requirements. In that case, the minimum flash point shall be 38°C, the minimum viscosity at 40°C shall be 1.7 mm^2/s, and the minimum 90 % recovered temperature shall be waived.

7.3 *Alternative Fuels and Blend Stocks:*

7.3.1 *Fuels Blended with Biodiesel*—The detailed requirements for fuels blended with biodiesel shall be as follows:

7.3.1.1 *Biodiesel for Blending*—If biodiesel is a component of any diesel fuel, the biodiesel shall meet the requirements of Specification D6751.

7.3.1.2 Diesel fuel oil containing up to 5 vol% biodiesel shall meet the requirements for the appropriate grade No. 1-D or No. 2-D fuel, as listed in Table 1.

7.3.1.3 Test Method D7371 shall be used for determination of the vol% biodiesel in a biodiesel blend. Test Method EN 14078 may also be used. In cases of dispute, Test Method D7371 shall be the referee test method. See Practice E29 for guidance on significant digits.

7.3.1.4 Diesel fuels containing more than 5 vol% biodiesel component are not included in this specification.

7.3.1.5 Biodiesel blends with No. 4–D fuel are not covered by this specification.

8. Precautionary Notes on Conductivity

8.1 Accumulation of static charge occurs when a hydrocarbon liquid flows with respect to another surface. The electrical conductivity requirement of 25 pS/m minimum at temperature of delivery shall apply when the transfer conditions in Table 2 exist for the delivery into a mobile transport container (for example, tanker trucks, railcars, and barges).

9. Keywords

9.1 biodiesel; biodiesel blend; diesel; fuel oil; petroleum and petroleum products

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TABLE 2 Transfer Conditions

Maximum Pipe Diameter (for a distance of 30 s upstream of delivery nozzle)	When Filling Tank Truck Compartments	When Filling Undivided Rail Car Compartments	When Filling Marine Vessels
0.1023 m	fuel velocity $ 4.9 m/s	fuel velocity $ 7.0 m/s	fuel velocity $ 7.0 m/s
0.1541 m	fuel velocity $ 3.24 m/s	fuel velocity $ 5.20 m/s	fuel velocity $ 7.0 m/s
0.2027 m	fuel velocity $ 2.47 m/s	fuel velocity $ 3.90 m/s	fuel velocity $ 7.0 m/s
0.2545 m	fuel velocity $ 1.96 m/s	fuel velocity $ 3.14 m/s	fuel velocity $ 7.0 m/s

APPENDIXES

(Nonmandatory Information)

X1. SIGNIFICANCE OF ASTM SPECIFICATION FOR DIESEL FUEL OILS

X1.1 Introduction

X1.1.1 The properties of commercial fuel oils depend on the refining practices employed and the nature of the crude oils from which they are produced. Distillate fuel oils, for example, can be produced within the boiling range of 150 and 400°C having many possible combinations of various properties, such as volatility, ignition quality, viscosity, and other characteristics.

X1.2 Grades

X1.2.1 This specification is intended as a statement of permissible limits of significant fuel properties used for specifying the wide variety of commercially available diesel fuel oils. Limiting values of significant properties are prescribed for seven grades of diesel fuel oils. These grades and their general applicability for use in diesel engines are broadly indicated as follows:

X1.2.2 *Grade No. 1-D S15*—Grade No. 1-D S15 comprises the class of very low sulfur, volatile fuel oils from kerosine to the intermediate middle distillates. Fuels within this grade are applicable for use in *(1)* high-speed diesel engines and diesel engine applications that require ultra-low sulfur fuels, *(2)* applications necessitating frequent and relatively wide variations in loads and speeds, and *(3)* applications where abnormally low operating temperatures are encountered.

X1.2.3 *Grade No. 1-D S500*—Grade No. 1-D S500 comprises the class of low-sulfur, volatile fuel oils from kerosine to the intermediate middle distillates. Fuels within this grade are applicable for use in *(1)* high-speed diesel engines that require low sulfur fuels, *(2)* in applications necessitating frequent and relatively wide variations in loads and speeds, and *(3)* in applications where abnormally low operating temperatures are encountered.

X1.2.4 *Grade No. 1-D S5000*—Grade No. 1-D S5000 comprises the class of volatile fuel oils from kerosine to the intermediate middle distillates. Fuels within this grade are applicable for use in high-speed diesel engines applications necessitating frequent and relatively wide variations in loads and speeds, and also for use in cases where abnormally low operating temperatures are encountered.

X1.2.5 *Grade No. 2-D S15*—Grade No. 2-D S15 includes the class of very low sulfur, middle distillate gas oils of lower volatility than Grade No. 1-D S15. These fuels are applicable for use in *(1)* high speed diesel engines and diesel engine applications that require ultra-low sulfur fuels, *(2)* applications necessitating relatively high loads and uniform speeds, or *(3)* diesel engines not requiring fuels having higher volatility or other properties specified in Grade No. 1-D S15.

X1.2.6 *Grade No. 2-D S500*—Grade No. 2-D S500 includes the class of low-sulfur, middle distillate gas oils of lower volatility than Grade No. 1-D S500. These fuels are applicable for use in *(1)* high-speed diesel engine applications that require low sulfur fuels, *(2)* applications necessitating relatively high loads and uniform speeds, or *(3)* diesel engines not requiring fuels having higher volatility or other properties specified for Grade No. 1-D S500.

X1.2.7 *Grade No. 2-D S5000*—Grade No. 2-D S5000 includes the class of middle distillate gas oils of lower volatility than Grade No. 1-D S5000. These fuels are applicable for use in *(1)* high-speed diesel engines in applications necessitating relatively high loads and uniform speeds, or *(2)* in diesel engines not requiring fuels having higher volatility or other properties specified for Grade No. 1-D S5000.

X1.2.8 *Grade No. 4-D*—Grade No. 4-D comprises the class of more viscous middle distillates and blends of these middle distillates with residual fuel oils. Fuels within this grade are applicable for use in low- and medium-speed diesel engines in applications necessitating sustained loads at substantially constant speed.

X1.3 Selection of Particular Grade

X1.3.1 The selection of a particular diesel fuel oil from one of these seven ASTM grades for use in a given engine requires consideration of the following factors:

X1.3.1.1 Fuel price and availability,

X1.3.1.2 Maintenance considerations,

X1.3.1.3 Engine size and design,

X1.3.1.4 Emission control systems,

X1.3.1.5 Speed and load ranges,

X1.3.1.6 Frequency of speed and load changes, and

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X1.3.1.7 Atmospheric conditions. Some of these factors can influence the required fuel properties outlined as follows:

X1.4 Cetane Number

X1.4.1 Cetane number is a measure of the ignition quality of the fuel and influences combustion roughness. The cetane number requirements depend on engine design, size, nature of speed and load variations, and on starting and atmospheric conditions. Increase in cetane number over values actually required does not materially improve engine performance. Accordingly, the cetane number specified should be as low as possible to assure maximum fuel availability.

X1.5 Distillation

X1.5.1 The fuel volatility requirements depend on engine design, size, nature of speed and load variations, and starting and atmospheric conditions. For engines in services involving rapidly fluctuating loads and speeds as in bus and truck operation, the more volatile fuels can provide best performance, particularly with respect to smoke and odor. However, best fuel economy is generally obtained from the heavier types of fuels because of their higher heat content.

X1.6 Viscosity

X1.6.1 For some engines it is advantageous to specify a minimum viscosity because of power loss due to injection pump and injector leakage. Maximum viscosity, on the other hand, is limited by considerations involved in engine design and size, and the characteristics of the injection system.

X1.7 Carbon Residue

X1.7.1 Carbon residue gives a measure of the carbon depositing tendencies of a fuel oil when heated in a bulb under prescribed conditions. While not directly correlating with engine deposits, this property is considered an approximation.

X1.8 Sulfur

X1.8.1 The effect of sulfur content on engine wear and deposits appears to vary considerably in importance and depends largely on operating conditions. Fuel sulfur can affect emission control systems performance. To assure maximum availability of fuels, the permissible sulfur content should be specified as high as is practicable, consistent with maintenance considerations.

X1.9 Flash Point

X1.9.1 The flash point as specified is not directly related to engine performance. It is, however, of importance in connection with legal requirements and safety precautions involved in fuel handling and storage, and is normally specified to meet insurance and fire regulations.

X1.10 Cloud Point

X1.10.1 Cloud point is of importance in that it defines the temperature at which a cloud or haze of wax crystals appears in the oil under prescribed test conditions which generally relates to the temperature at which wax crystals begin to precipitate from the oil in use.

X1.11 Ash

X1.11.1 Ash-forming materials can be present in fuel oil in two forms: *(1)* abrasive solids, and *(2)* soluble metallic soaps. Abrasive solids contribute to injector, fuel pump, piston and ring wear, and also to engine deposits. Soluble metallic soaps have little effect on wear but can contribute to engine deposits.

X1.12 Copper Strip Corrosion

X1.12.1 This test serves as a measure of possible difficulties with copper and brass or bronze parts of the fuel system.

X1.13 Aromaticity

X1.13.1 This test is used as an indication of the aromatics content of diesel fuel. Aromatics content is specified to prevent an increase in the average aromatics content in Grades No. 1-D S15, No. 1-D S500, No. 2-D S15 and No. 2-D S500 fuels and is required by 40 CFR Part 80. Increases in aromatics content of fuels over current levels can have a negative impact on emissions.

X1.14 Cetane Index

X1.14.1 Cetane Index is specified as a limitation on the amount of high aromatic components in Grades No. 1-D S15, No. 1-D S500, No. 2-D S15 and No. 2-D S500.

X1.15 Other

X1.15.1 *Microbial Contamination*—Refer to Guide D6469 for a discussion of this form of contamination.

X1.16 Conductivity

X1.16.1 Electrical conductivity of fuels is an important consideration in the safe handling characteristics of any fuel. The risk associated with explosions due to static electrical discharge depends on the amount of hydrocarbon and oxygen in the vapor space and the energy and duration of a static discharge. There are many factors that can contribute to the high risk of explosion. For Ultra Low Sulfur Diesel (ULSD) fuels in particular, electrical conductivity can likely be very low before the addition of static dissipater additive (SDA). The intent of this requirement is to reduce the risk of electrostatic ignitions while filling tank trucks, barges, ship compartments, and rail cars, where flammable vapors from the past cargo can be present. Generally, it does not apply at the retail level where flammable vapors are usually absent. Those parties handling any fuel are advised to review Guide D4865 as well as API RP 2003 and ISGOTT.[8]

X1.16.2 Conductivity is known to be highly dependent on temperature. The conductivity requirement in Table 1 will decrease the risk, but it will not eliminate it.

X1.16.3 Fig. X1.1 presents the response of conductivity to temperature for some typical diesel fuels.

[8] *ISGOTT (International Safety Guide for Oil Tankers and Terminals)* , 5th edition, Oil Companies International Marine Forum (OCIMF), London, England, www.ocimf.com.

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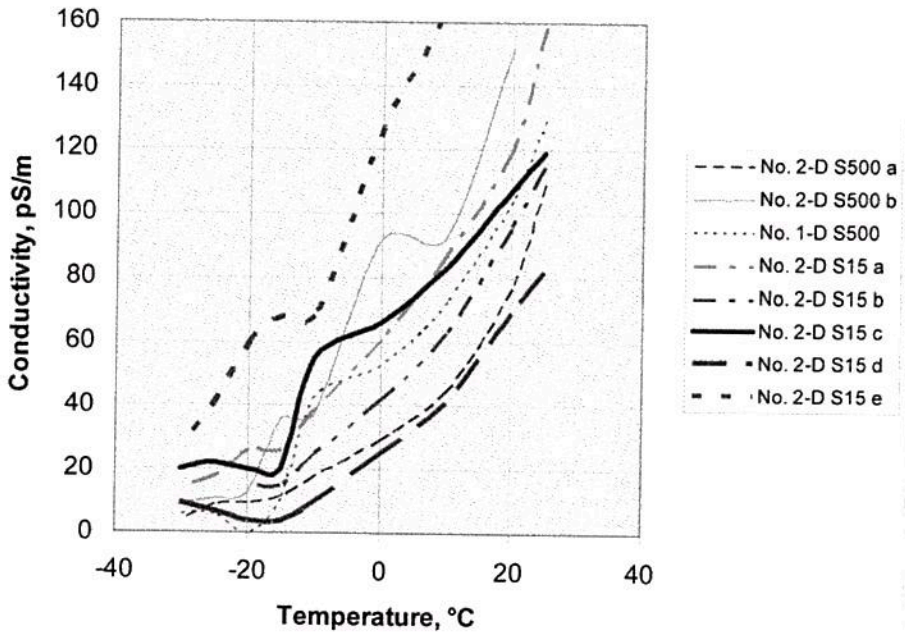

FIG. X1.1 Conductivity Varies with Temperature

X1.16.4 Due to the normal depletion of fuel conductivity additive during commingling, storage, distribution, or reduction of conductivity, or a combination thereof, at low temperatures, the fuel should be sufficiently treated, if needed with conductivity improver additives (also called static dissipater additives (SDA)) to ensure that the electrical conductivity requirement is met. The method of fuel distribution and temperature at the point of delivery into mobile transport can require a substantially greater conductivity level than 25 pS/m at the point of additive treatment. If a static dissipater additive is needed to meet the minimum conductivity requirement, then initial additive treatment should allow for temperature, commingling, distribution, and adequate mixing effects to ensure the minimum conductivity is attained at the point of delivery into mobile transport. For more information on this subject, please refer to Guide D4865 and Test Method D2624.

X1.16.5 Fuel handlers should not be lulled into a false sense of security if the fuel meets or exceeds the minimum conductivity requirement. Improved fuel conductivity will accelerate the dissipation of electric charge but not eliminate the risks associated with handling combustible or flammable fuels. Fuel handlers should be aware of the increased static electricity production when diesel fuels are filtered through fine-mesh strainers and filters. Fuel handlers are encouraged to use industry-recommended safety practices to minimize the risk associated with handling fuel. One such safe operating practice recommends lower maximum flowrates upon initial loading procedures. Loading operations involving "switch-loading" of tanker trucks and other vessels pose increased risks.

X1.16.6 There is some concern over excessive additization of diesel fuel with static dissipater additives. A potential concern includes failure of exposed electrical equipment immersed in over-additized fuel. Another concern is potential interference with the properties of adjacent products in pipeline. Fuel handlers using static dissipater additives should employ effective controls to prevent over-additizing diesel fuel. Fuel handlers adding SDA or other additives should be aware of possible antagonistic or synergistic effects between additives used simultaneously in diesel fuel. Consultation with the appropriate SDA additive supplier or other experts, or both, as well as conducting appropriate additive interaction studies is recommended.

X1.16.7 For those fuel transporters that practice switch loading of fuels without container cleaning and purging after hauling high or intermediate fuels or solvents, risks are involved with that practice. Switch loading should be discouraged because of the difficulty in ensuring removal of all residual vapor-producing materials. Accidental electrostatic discharge ignition requires three elements:

(1) Presence of a flammable atmosphere from a previous volatile cargo,

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(2) The ability of the low volatility material being loaded to accumulate an electrostatic charge because of low conductivity, and

(3) Operating conditions during loading, which encourage charge generation and reduce charge relaxation—especially the velocity of the loading stream. Switch loading also refers to the reverse situation when light product (for example, gasoline) is loaded into a container that previously held middle distillate fuel (for example, diesel), although this mode of switch loading is generally not considered a static ignition hazard (but may be a product contamination concern).

X2. SAMPLING, CONTAINERS AND SAMPLE HANDLING

X2.1 Introduction

X2.1.1 This appendix provides guidance on methods and techniques for the proper sampling of diesel fuel oils. As diesel fuel oil specifications become more stringent and contaminants and impurities become more tightly controlled, even greater care needs to be taken in collecting and storing samples for quality assessment.

X2.2 Sampling, Containers and Sample Handling Recommendations

X2.2.1 Appropriate manual method sampling procedures can be found in Practice D4057 and automatic method sampling is covered in Practice D4177.

X2.2.2 The correct sample volume and appropriate container selection are also important decisions that can impact test results. Practice D4306 for aviation fuel container selection for tests sensitive to trace contamination can be useful. Practice D5854 for procedures on container selection and sample mixing and handling is recommended. For cetane number determination protection from light is important. Collection and storage of diesel fuel oil samples in an opaque container, such as a dark brown glass bottle, metal can, or a minimally reactive plastic container to minimize exposure to UV emissions from sources such as sunlight or fluorescent lamps, is recommended. According to Paragraph 8.2 of Test Method D6079, "Because of sensitivity of lubricity measurements to trace materials, sample containers shall be only fully epoxy-lined metal, amber borosilicate glass, or polytetrafluoroethylene as specified in Practice D4306."

X2.2.3 For volatility determination of a sample, Practice D5842 for special precautions recommended for representative sampling and handling techniques may be appropriate.

X3. STORAGE AND THERMAL STABILITY OF DIESEL FUELS

X3.1 Scope

X3.1.1 This appendix provides guidance for consumers of diesel fuels who may wish to store quantities of fuels for extended periods or use the fuel in severe service or high temperature applications. Fuels containing residual components are excluded. Consistently successful long-term fuel storage or use in severe applications requires attention to fuel selection, storage conditions, handling and monitoring of properties during storage and prior to use.

X3.1.2 Normally produced fuels have adequate stability properties to withstand normal storage and use without the formation of troublesome amounts of insoluble degradation products. Fuels that are to be stored for prolonged periods or used in severe applications should be selected to avoid formation of sediments or gums, which can overload filters or plug injectors. Selection of these fuels should result from supplier-user discussions.

X3.1.3 These suggested practices are general in nature and should not be considered substitutes for any requirements imposed by the warranty of the distillate fuel equipment manufacturer or by federal, state, or local government regulations. Although they cannot replace a knowledge of local conditions or good engineering and scientific judgment, these suggested practices do provide guidance in developing an individual fuel management system for the middle distillate fuel user. They include suggestions in the operation and maintenance of existing fuel storage and handling facilities and for identifying where, when, and how fuel quality should be monitored or selected for storage or severe use.

X3.2 Definitions

X3.2.1 *bulk fuel*—fuel in the storage facility.

X3.2.2 *fuel contaminants*—foreign materials that make fuel less suitable or unsuitable for the intended use.

X3.2.2.1 *Discussion*—Fuel contaminants include materials introduced subsequent to the manufacture of fuel and fuel degradation products.

X3.2.3 *fuel-degradation products*—those materials that are formed in fuel during extended storage or exposure to high temperatures.

X3.2.3.1 *Discussion*—Insoluble degradation products can combine with other fuel contaminants to reinforce deleterious effects. Soluble degradation products (soluble gums) are less volatile than fuel and can carbonize to form deposits due to complex interactions and oxidation of small amounts of olefinic or sulfur-, oxygen- or nitrogen-containing compounds present in fuels. The formation of degradation products can be catalyzed by dissolved metals, especially copper salts. When dissolved copper is present it can be deactivated with metal deactivator additives.

X3.2.4 *long-term storage*—storage of fuel for longer than 12 months after it is received by the user.

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X3.2.5 *severe use*—use of the fuel in applications which can result in engines operating under high load conditions that can cause the fuel to be exposed to excessive heat.

X3.3 Fuel Selection

X3.3.1 Certain distilled refinery products are generally more suitable for long-term storage and severe service than others. The stability properties of middle distillates are highly dependent on the crude oil sources, severity of processing, use of additives and whether additional refinery treatment has been carried out.

X3.3.2 The composition and stability properties of middle distillate fuels produced at specific refineries can be different. Any special requirements of the user, such as long-term storage or severe service, should be discussed with the supplier.

X3.3.3 Blends of fuels from various sources can interact to give stability properties worse than expected based on the characteristics of the individual fuels.

X3.4 Fuel Additives

X3.4.1 Available fuel additives can improve the suitability of marginal fuels for long-term storage and thermal stability, but can be unsuccessful for fuels with markedly poor stability properties. Most additives should be added at the refinery or during the early weeks of storage to obtain maximum benefits.

X3.4.2 Biocides or biostats destroy or inhibit the growth of fungi and bacteria, which can grow at fuel-water interfaces to give high particulate concentrations in the fuel. Available biocides are soluble in both the fuel and water or in the water phase only.

X3.5 Tests for Fuel Quality

X3.5.1 At the time of manufacture, the storage stability of fuel may be assessed using Test Method D2274 or D5304. However, these accelerated stability tests may not correlate well with field storage stability due to varying field conditions and to fuel composition.

X3.5.2 Performance criteria for accelerated stability tests that assure satisfactory long-term storage of fuels have not been established.

X3.5.3 Test Method D6468, provides an indication of thermal oxidative stability of middle distillate fuels when heated to temperatures near 150°C.

X3.6 Fuel Monitoring

X3.6.1 A plan for monitoring the quality of bulk fuel during prolonged storage is an integral part of a successful program. A plan to replace aged fuel with fresh product at established intervals is also desirable.

X3.6.2 Stored fuel should be periodically sampled and its quality assessed. Practice D4057 provides guidance for sampling. Fuel contaminants and degradation products will usually settle to the bottom of a quiescent tank. A "Bottom" or "Clearance" sample, as defined in Practice D4057, should be included in the evaluation along with an "All Level" sample.

X3.6.3 The quantity of insoluble fuel contaminants present in fuel can be determined using Test Method D6217.

X3.6.4 Test Method D6468, can be used for investigation of operational problems that might be related to fuel thermal stability. Testing samples from the fuel tank or from bulk storage can give an indication as to the cause of filter plugging. It is more difficult to monitor the quality of fuels in vehicle tanks since operation can be on fuels from multiple sources.

X3.6.5 Some additives exhibit effects on fuels tested in accordance with Test Method D6468 that may or may not be observed in the field. Data have not been developed that correlate results from the test method for various engine types and levels of operating severity.

X3.6.6 Test Method D7619 can be used to assess the number and size of particulates in Grades 1-D and 2-D diesel fuels. However water droplets are counted as particles and agglomerated particles are detected and counted as a single larger particle. Data have not been developed to determine acceptable levels of particulates. Obtaining a representative sample and following the recommended sampling procedures is particularly important with particle counting test methods.

X3.7 Fuel Storage Conditions

X3.7.1 Contamination levels in fuel can be reduced by storage in tanks kept free of water, and tankage should have provisions for water draining on a scheduled basis. Water promotes corrosion, and microbiological growth can occur at a fuel-water interface. Underground storage is preferred to avoid temperature extremes; above-ground storage tanks should be sheltered or painted with reflective paint. High storage temperatures accelerate fuel degradation. Fixed roof tanks should be kept full to limit oxygen supply and tank breathing.

X3.7.2 Copper and copper-containing alloys should be avoided. Copper can promote fuel degradation and can produce mercaptide gels. Zinc coatings can react with water or organic acids in the fuel to form gels that rapidly plug filters.

X3.7.3 Appendix X2 of Specification D2880 discusses fuel contaminants as a general topic.

X3.8 Fuel Use Conditions

X3.8.1 Many diesel engines are designed so that the diesel fuel is used for heat transfer. In modern heavy-duty diesel engines, for example, only a portion of the fuel that is circulated to the fuel injectors is actually delivered to the combustion chamber. The remainder of the fuel is circulated back to the fuel tank, carrying heat with it. Thus adequate high temperature stability can be a necessary requirement in some severe applications or types of service.

X3.8.2 Inadequate high temperature stability can result in the formation of insoluble degradation products.

X3.9 Use of Degraded Fuels

X3.9.1 Fuels that have undergone mild-to-moderate degradation can often be consumed in a normal way, depending on the fuel system requirements. Filters and other cleanup equipment can require special attention and increased maintenance. Burner nozzle or injector fouling can occur more rapidly.

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X3.9.2 Fuels containing very large quantities of fuel degradation products and other contaminants or with runaway microbiological growth require special attention. Consultation with experts in this area is desirable. It can be possible to drain the sediment or draw off most of the fuel above the sediment layer and use it with the precautions described in X3.9.1. However, very high soluble gum levels or corrosion products from microbiological contamination can cause severe operational problems.

X3.10 Thermal Stability Guidelines

X3.10.1 Results from truck fleet experience suggests that Test Method D6468 can be used to qualitatively indicate whether diesel fuels have satisfactory thermal stability performance properties.[9,10]

X3.10.2 Performance in engines has not been sufficiently correlated with results from Test Method D6468 to provide definitive specification requirements. However, the following guidelines are suggested.

X3.10.2.1 Fuels giving a Test Method D6468 reflectance value of 70 % or more in a 90 minute test at the time of manufacture should give satisfactory performance in normal use.

X3.10.2.2 Fuels giving a Test Method D6468 reflectance value of 80 % or more in a 180 minute test at the time of manufacture should give satisfactory performance in severe use.

X3.10.3 Thermal stability as determined by Test Method D6468 is known to degrade during storage.[11] The guidance above is for fuels used within six months of manufacture.

[9] Bacha, John D., and Lesnini, David G., "Diesel Fuel Thermal Stability at 300°F," *Proceedings of the 6th International Conference on Stability and Handling of Liquid Fuels*, Vancouver, B.C., October 1997.

[10] Schwab, Scott D., Henly, Timothy J., Moxley, Joel F., and Miller, Keith, "Thermal Stability of Diesel Fuel," *Proceedings of the 7th International Conference on Stability and Handling of Liquid Fuels*, Graz, Austria, September 2000.

[11] Henry, C. P., "The DuPont F21 149°C (300°F) Accelerated Stability Test," *Distillate Fuel Stability and Cleanliness, ASTM STP 751*, 1981, pp. 22-33.

X4. DIESEL FUEL LUBRICITY

X4.1 Introduction

X4.1.1 Diesel fuel functions as a lubricant in most components of fuel injection equipment such as pumps and injectors. In limited cases, fuel with specific properties will have insufficient lubricating properties which will lead to a reduction in the normal service life and functional performance of diesel fuel injection systems.

X4.2 Fuel Characteristics Affecting Equipment Wear

X4.2.1 Currently, two fuel characteristics affect equipment wear. These are low viscosity and lack of sufficient quantities of trace components that have an affinity for surfaces. If fuel viscosity meets the requirements of a particular engine, a fuel film is maintained between the moving surfaces of the fuel system components. This prevents excessive metal-to-metal contact and avoids premature failure due to wear. Similarly, certain surface active molecules in the fuel adhere to, or combine with, surfaces to produce a protective film which also can protect surfaces against excessive wear.

X4.3 Fuel Lubricity

X4.3.1 The concern about fuel lubricity is limited to situations in which fuels with lower viscosities than those specified for a particular engine are used or in which fuels that have been processed in a manner that results in severe reduction of the trace levels of the surface active species that act as surface protecting agents. Presently the only fuels of the latter type shown to have lubricity problems resulted from sufficiently severe processing to reduce aromatics or sulfur.

X4.3.2 Work in the area of diesel fuel lubricity is ongoing by several organizations, such as the International Organization for Standardization (ISO), the ASTM Diesel Fuel Lubricity Task Force, and the Coordinating Research Council (CRC) Diesel Performance Group. These groups include representatives from the fuel injection equipment manufacturers, fuel producers, and additive suppliers. The charge of the ASTM task force has been the recommendation of test methods and fuel lubricity requirements for Specification D975. Two test methods were proposed and approved. These are Test Method D6078, a scuffing load ball-on-cylinder lubricity evaluator method, SLBOCLE, and Test Method D6079, a high frequency reciprocating rig (HFRR) method. Use of these tests raises three issues: 1) The correlation of the data among the two test methods and the fuel injection equipment is not perfect, 2) Both methods in their current form do not apply to all fuel-additive combinations, and 3) The reproducibility values for both test methods are large. In order to protect diesel fuel injection equipment, an HFRR Wear Scar Diameter (WSD) of 520 microns has been placed in Specification D975.[12]

X4.3.3 Most experts agree that fuels having a SLBOCLE lubricity value below 2000 g might not prevent excessive wear in injection equipment[13] while fuels with values above 3100 g should provide sufficient lubricity in all cases.[14] Experts also agree that if HFFR test at 60°C is used, fuels with values above 600 microns might not prevent excessive wear,[15] while fuels with values below 450 microns should provide sufficient lubricity in all cases.[14] More accurately, an industry-accepted long-term durability pump test, such as Test Method D6898,

[12] Mitchell, K., "Diesel Fuel Lubricity—Base Fuel Effects," SAE Technical Paper 2001–01–1928, 2001.

[13] Westbrook, S. R., "Survey of Low Sulfur Diesel Fuels and Aviation Kerosenes from U.S. Military Installations," SAE Technical Paper 952369, 1995.

[14] Nikanjam, M., "ISO Diesel Fuel Lubricity Round Robin Program," SAE Technical Paper 952372, 1995.

[15] Nikanjam, M., "Diesel Fuel Lubricity: On the Path to Specifications ," SAE Technical Paper 1999-01-1479, 1999.

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can be used to evaluate the lubricity of a diesel fuel. A poor result in such a test indicates that the fuel has low lubricity and may not be able to provide sufficient protection.

NOTE X4.1—Some injection equipment can be fitted with special components that can tolerate low lubricity fuels.

X5. TENTH PERCENTILE MINIMUM AMBIENT AIR TEMPERATURES FOR THE UNITED STATES (EXCEPT HAWAII)

X5.1 Introduction

X5.1.1 The tenth percentile minimum ambient air temperatures shown on the following maps (Figs. X5.1-X5.12) and in Table X5.1 were derived from an analysis of historical hourly temperature readings recorded over a period of 15 to 21 years from 345 weather stations in the United States. This study was conducted by the U.S. Army Mobility Equipment Research and Development Center (USAMERDC), Coating and Chemical Laboratory, Aberdeen Proving Ground, MD 21005. The tenth percentile minimum ambient air temperature is defined as the lowest ambient air temperature which will not go lower on average more than 10 % of the time. In other words, the daily minimum ambient air temperature would on average not be expected to go below the monthly tenth percentile minimum ambient air temperature more than 3 days for a 30-day month. See Table X5.1.

X5.1.2 These data can be used to estimate low temperature operability requirements. In establishing low temperature operability requirements, consideration should be given to the following. These factors, or any combination, can make low temperature operability more or less severe than normal. As X5.1.2.1 through X5.1.2.12 indicate, field work suggests that cloud point (or wax appearance point) is a fair indication of the low temperature operability limit of fuels without cold flow additives in most vehicles.

X5.1.2.1 Long term weather patterns (Average winter low temperatures will be exceeded on occasion).

X5.1.2.2 Short term local weather conditions (Unusual cold periods do occur).

X5.1.2.3 Elevation (High locations are usually colder than surrounding lower areas).

X5.1.2.4 Specific engine design.

X5.1.2.5 Fuel system design (Recycle rate, filter location, filter capacity, filter porosity, and so forth.)

X5.1.2.6 Fuel viscosity at low temperatures

X5.1.2.7 Equipment add-ons (Engine heaters, radiator covers, fuel line and fuel filter heaters and so forth.)

X5.1.2.8 Types of operation (Extensive idling, engine shutdown, or unusual operation).

X5.1.2.9 Low temperature flow improver additives in fuel.

X5.1.2.10 Geographic area for fuel use and movement between geographical areas.

X5.1.2.11 General housekeeping (Dirt or water, or both, in fuel or fuel supply system).

X5.1.2.12 Impact failure for engine to start or run (Critical vs. non-critical application).

X5.1.3 *Historical Background*—Three test methods have been widely used to estimate or correlate with low temperature vehicle operability. Cloud point, Test Method D2500, is the oldest of the three and most conservative of the tests. The cloud point test indicates the earliest appearance of wax precipitation that might result in plugging of fuel filters or fuel lines under prescribed cooling conditions. Although not 100 % failsafe, it is the most appropriate test for applications that can not tolerate much risk. The Cold Filter Plugging Point (CFPP) test, Test Method D6371, was introduced in Europe in 1965. The CFPP was designed to correlate with the majority of European vehicles. Under rapid cooling conditions, 20 cc fuel is drawn through a 45 micron screen then allowed to flow back through the screen for further cooling. This process is continued every 1°C until either the 20 cc fuel fails to be drawn through the screen in 60 s or it fails to return through the screen in 60 s. It was field tested many times in Europe[16] before being widely accepted as a European specification. Field tests have also shown CFPP results more than 10°C below the cloud point should be viewed with caution because those results did not necessarily reflect the true vehicle low temperature operability limits.[17] CFPP has been applied to many areas of the world where similar vehicle designs are used. The Low Temperature Flow Test (LTFT), Test Method D4539, was designed to correlate with the most severe and one of the most common fuel delivery systems used in North American Heavy Duty trucks. Under prescribed slow cool conditions (1°C/h), similar to typical field conditions, several 200 cc fuel specimens in glass containers fitted with 17 µm screen assemblies are cooled. At 1°C intervals one specimen is drawn through the screen under a 20 kPa vacuum. Approximately 90 % of the fuel must come over in 60 s or less for the result to be a pass. This process is continued at lower temperatures (1°C increments) until the fuel fails to come over in the allotted 60 s. The lowest passing temperature is defined as the LTFT for that fuel. In 1981, a CRC program was conducted to evaluate the efficacy of cloud point, CFPP, pour point, and LTFT for protecting the diesel vehicle population in North America and to determine what benefit flow-improvers could provide. The field test consisted of 3 non-flow improved diesel fuels, 5 flow improved diesel fuels, 4 light-duty passenger cars, and 3 heavy-duty trucks. The field trial resulted in two documents[18,19] that provide insight into correlating laboratory tests to North American vehicle performance in the field. The general conclusions of the study were:

[16] "Low Temperature Operability of Diesels. A Report by CEC Investigation Group IGF-3," CEC P-171–82.

[17] "SFPP-A New Laboratory Test for Assessment of Low Temperature Operability of Modern Diesel Fuels," CEC/93/EF 15, 5–7, May 1993.

[18] CRC Report No. 537, "The Relationship Between Vehicle Fuel Temperature and Ambient Temperature, 1981 CRC Kapuskasing Field Test," December 1983.

[19] CRC Report No. 528, "1981 CRC Diesel Fuel Low-Temperature Operability Field Test," September 1983.

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(1) In overnight cool down, 30 % of the vehicles tested had a final fuel tank temperature within 2°C of the overnight minimum ambient temperature.

(2) The use of flow-improved diesel fuel permits some vehicles to operate well below the fuel cloud point.

(3) Significant differences exist in the severity of diesel vehicles in terms of low temperature operation.

(4) No single laboratory test was found that adequately predicts the performance of all fuels in all vehicles.

(5) CFPP was a better predictor than pour point, but both methods over-predicted, minimum operating temperatures in many vehicles. For this reason, these tests were judged inadequate predictors of low-temperature performance and dismissed from further consideration.

(6) Cloud point and LTFT showed varying degrees of predictive capability, and offered distinctively different advantages. Both predicted the performance of the base fuels well, but LTFT more accurately predicted the performance of the flow-improved fuels. On the other hand, cloud point came closest to a fail-safe predictor of vehicle performance for all vehicles.

Since the 1981 field test, non-independent studies[20] using newer vehicles verified the suitability of the LTFT for North American heavy-duty trucks. Users are advised to review these and any more recent publications when establishing low temperature operability requirements and deciding upon test methods.

X5.1.3.1 *Current Practices*—It is recognized that fuel distributors, producers, and end users in the United States use cloud point, wax appearance point, CFPP, and LTFT to estimate vehicle low temperature operability limits for diesel fuel. No independent data has been published in recent years to determine test applicability for today's fuels and vehicles.

[20] SAE 962197, SAE 982576, SAE 2000-01-2883.

X5.2 Maps

X5.2.1 The maps in the following figures were derived from CCL Report No. 316, "A Predictive Study for Defining Limiting Temperatures and Their Application in Petroleum Product Specifications," by John P. Doner. This report was published by the U.S. Army Mobility Equipment Research and Development Center (USAMERDC), Coating and Chemical Laboratory, and it is available from the National Technical Information Service, Springfield, VA 22151, by requesting Publication No. AD756-420.

X5.2.2 Where states are divided the divisions are noted on the maps and table with the exception of California, which is divided by counties as follows:

California, North Coast—Alameda, Contra Costa, Del Norte, Humbolt, Lake, Marin, Mendocino, Monterey, Napa, San Benito, San Francisco, San Mateo, Santa Clara, Santa Cruz, Solano, Sonoma, Trinity.

California, Interior—Lassen, Modoc, Plumas, Sierra, Siskiyou, Alpine, Amador, Butte, Calaveras, Colusa, El Dorado, Fresno, Glenn, Kern (except that portion lying east of the Los Angeles County Aqueduct), Kings, Madera, Mariposa, Merced, Placer, Sacramento, San Joaquin, Shasta, Stanislaus, Sutter, Tehama, Tulare, Tuolumne, Yolo, Yuba, Nevada.

California, South Coast—Orange, San Diego, San Luis Obispo, Santa Barbara, Ventura, Los Angeles (except that portion north of the San Gabriel Mountain range and east of the Los Angeles County Aqueduct).

California, Southeast—Imperial, Riverside, San Bernardino, Los Angeles (that portion north of the San Gabriel Mountain range and east of the Los Angeles County Aqueduct), Mono, Inyo, Kern (that portion lying east of the Los Angeles County Aqueduct).

X5.2.3 The temperatures in CCL Report No. 316 were in degrees Fahrenheit. The degree Celsius temperatures in Appendix X5 were obtained by converting the original degree Fahrenheit temperatures.

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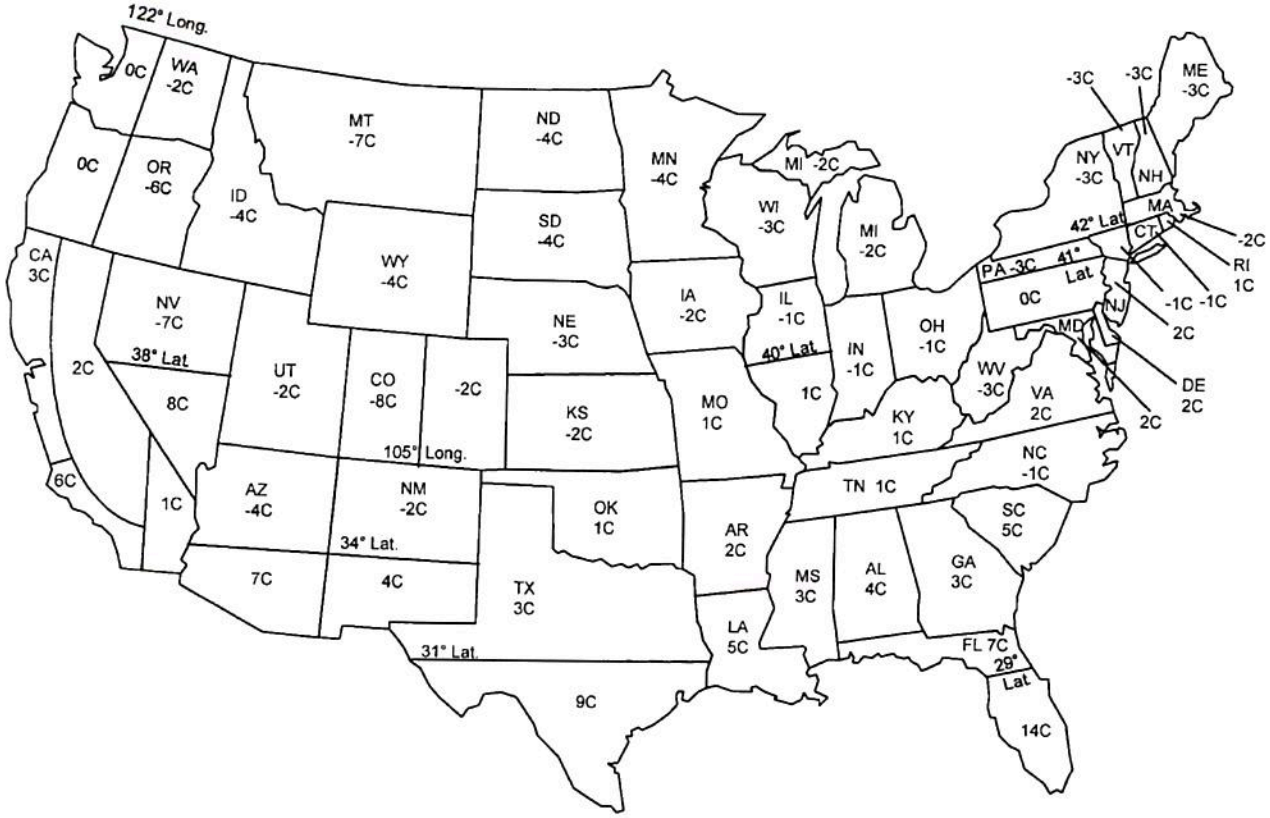

FIG. X5.1 October—10th Percentile Minimum Temperatures

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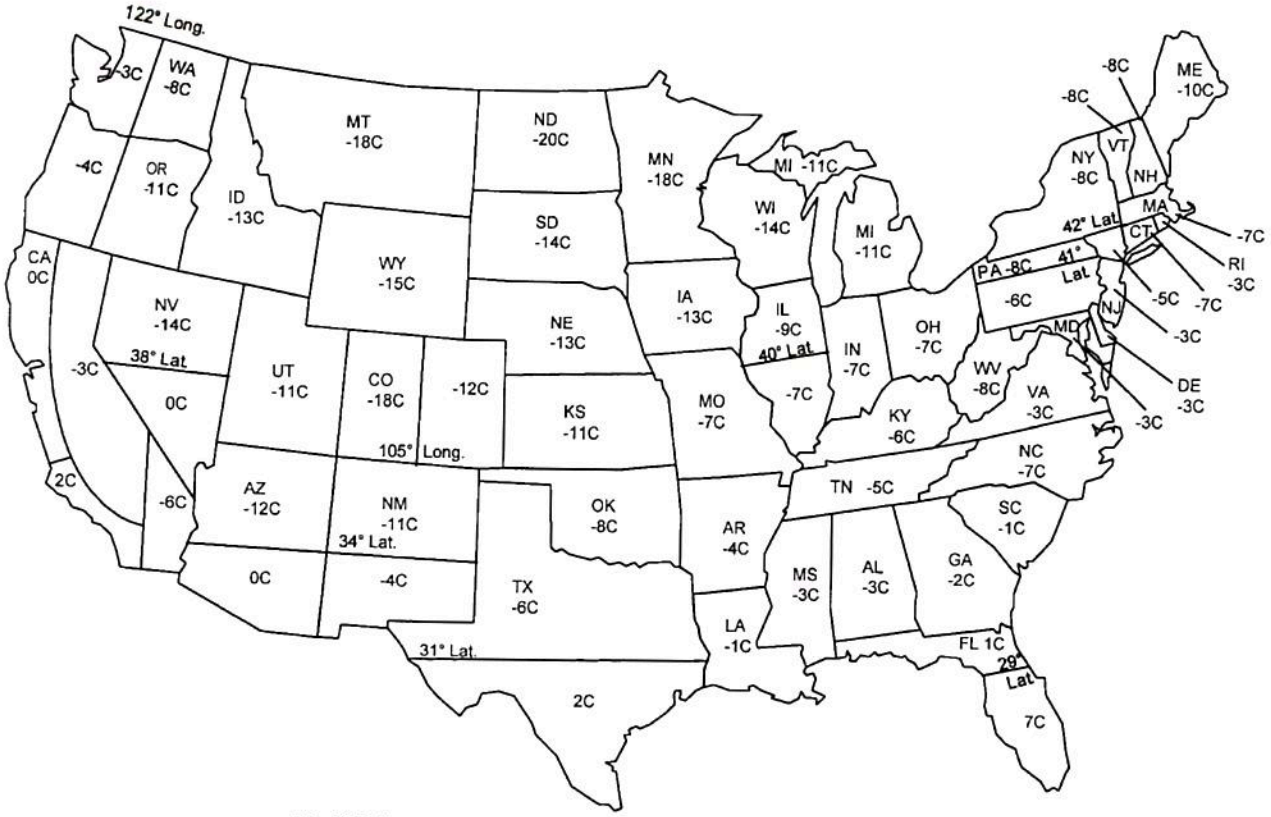

FIG. X5.2 November—10th Percentile Minimum Ambient Air Temperatures

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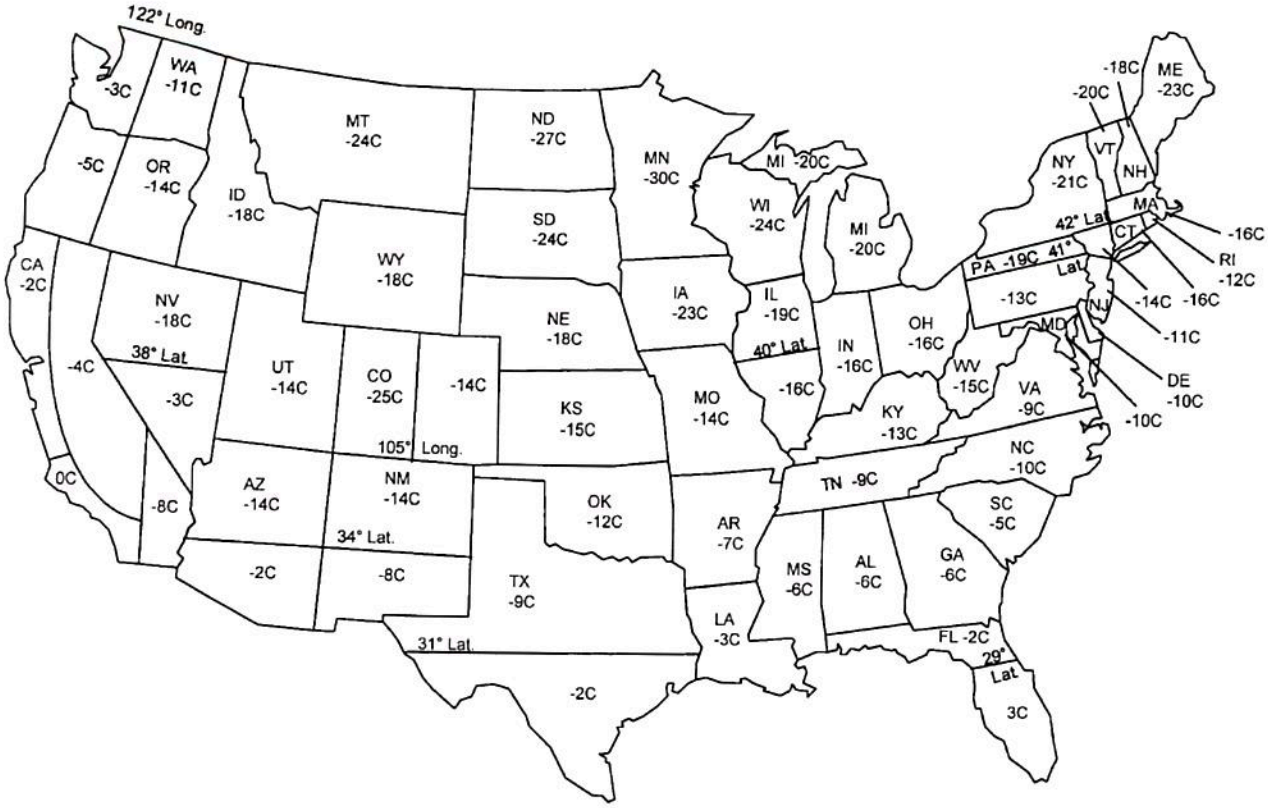

FIG. X5.3 December—10th Percentile Minimum Ambient Air Temperatures

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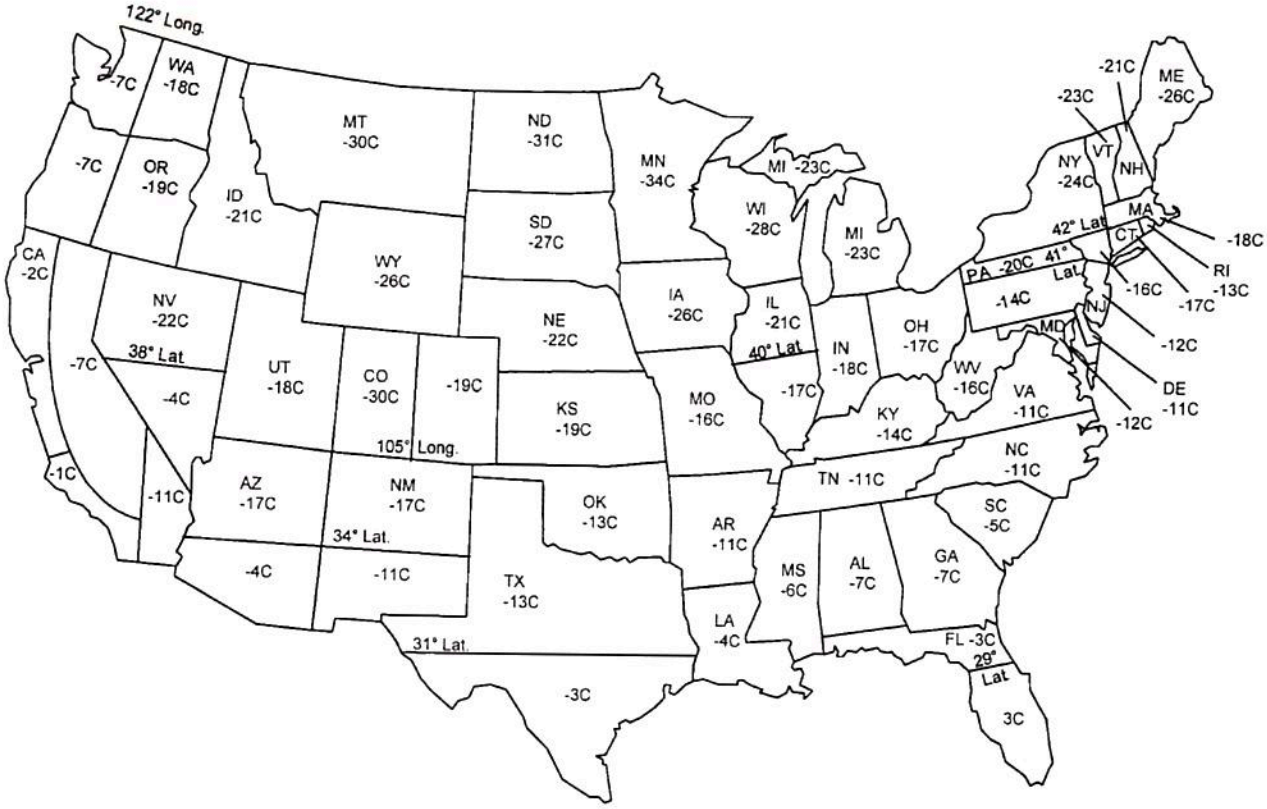

FIG. X5.4 January—10th Percentile Minimum Ambient Air Temperatures

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FIG. X5.5 February—10th Percentile Minimum Ambient Air Temperatures

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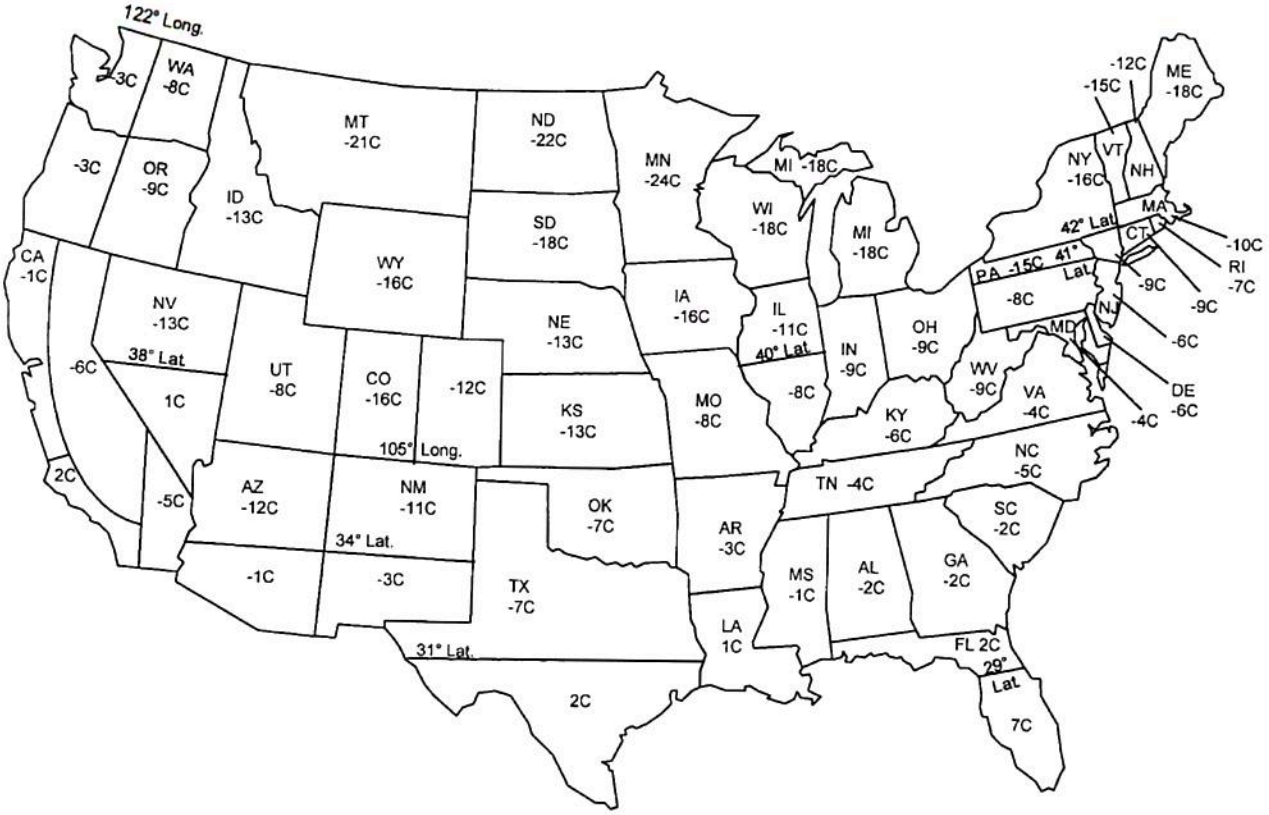

FIG. X5.6 March—10th Percentile Minimum Ambient Air Temperatures

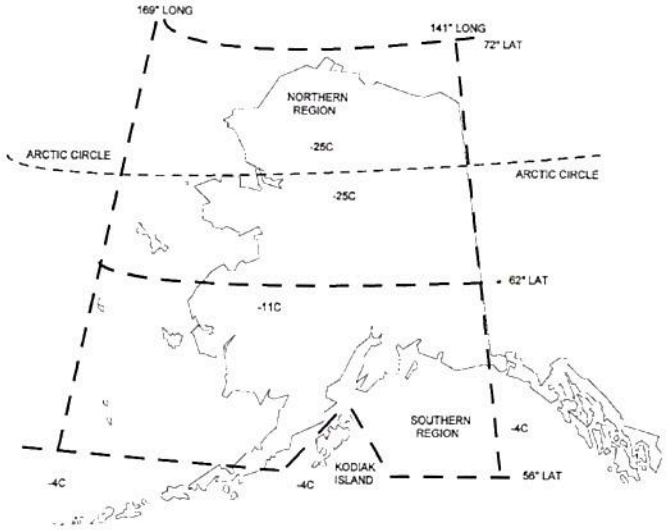

FIG. X5.7 October—10th Percentile Minimum Ambient Air Temperatures

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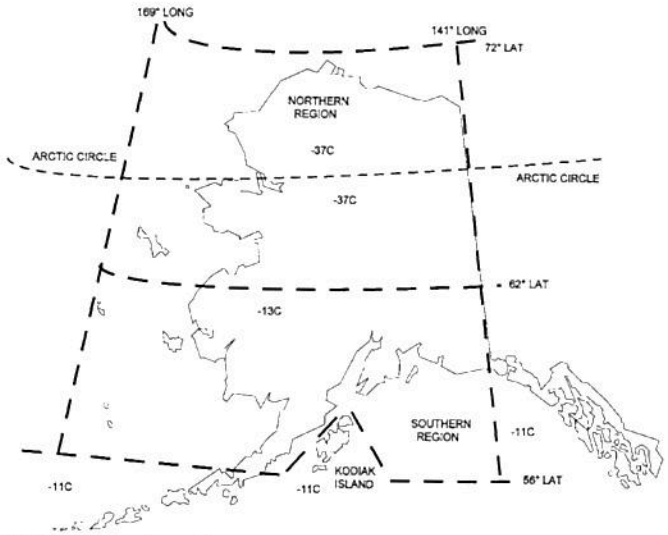

FIG. X5.8 November—10th Percentile Minimum Ambient Air Temperatures

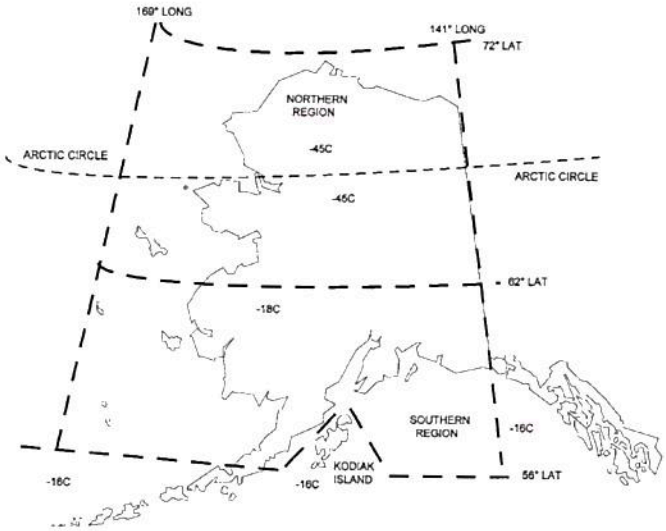

FIG. X5.9 December—10th Percentile Minimum Ambient Air Temperatures

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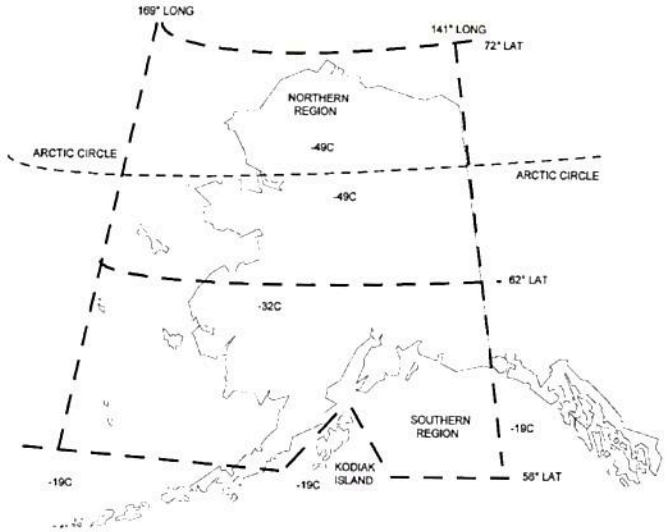

FIG. X5.10 January—10th Percentile Minimum Ambient Air Temperatures

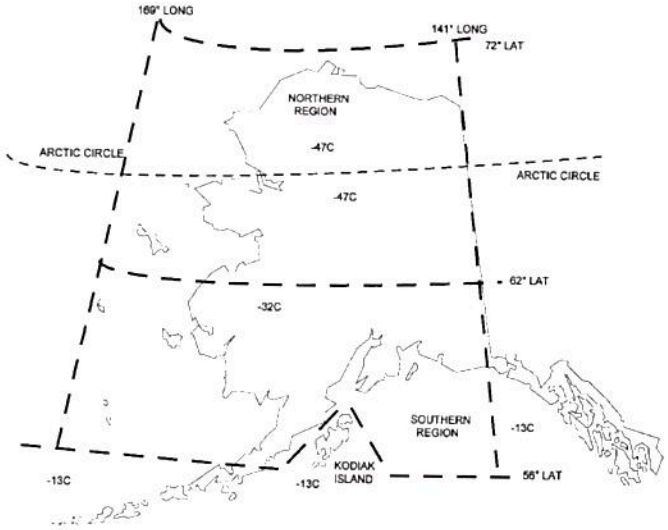

FIG. X5.11 February—10th Percentile Minimum Ambient Air Temperatures

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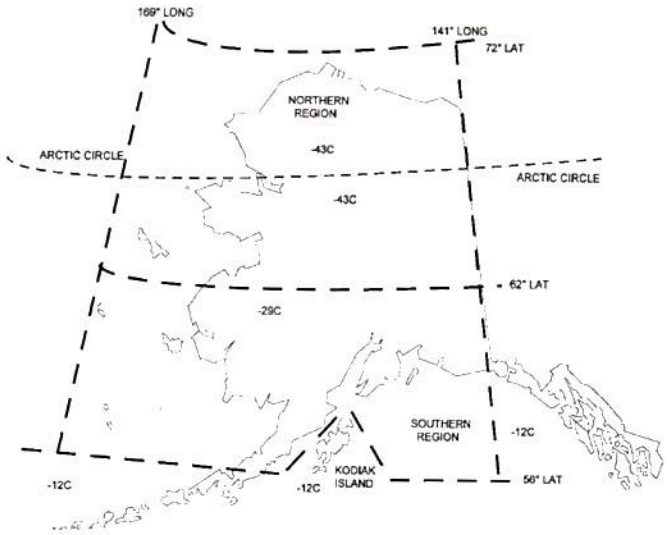

FIG. X5.12 March—10th Percentile Minimum Ambient Air Temperatures

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TABLE X5.1 Tenth Percentile Minimum Ambient Air Temperatures for the United States (except Hawaii)

State		10th Percentile Temperature°C, min					
		Oct.	Nov.	Dec.	Jan.	Feb.	March
Alabama		4	-3	-6	-7	-3	-2
Alaska	Northern	-25	-37	-45	-49	-47	-43
	Southern	-11	-13	-18	-32	-32	-29
	South East	-4	-11	-16	-19	-13	-12
Arizona	North 34° latitude	-4	-12	-14	-17	-16	-12
	South 34° latitude	7	0	-2	-4	-3	-1
Arkansas		2	-4	-7	-11	-7	-3
California	North Coast	3	0	-2	-2	-1	-1
	Interior	2	-3	-4	-7	-6	-6
	South Coast	6	2	0	-1	0	2
	Southeast	1	-6	-8	-11	-7	-5
Colorado	East 105° long	-2	-12	-14	-19	-15	-12
	West 105° long	-8	-18	-25	-30	-24	-16
Connecticut		-1	-7	-16	-17	-16	-9
Delaware		2	-3	-10	-11	-10	-6
Florida	North 29° latitude	7	1	-2	-3	-1	2
	South 29° latitude	14	7	3	3	5	7
Georgia		3	-2	-6	-7	-6	-2
Idaho		-4	-13	-18	-21	-18	-13
Illinois	North 40° latitude	-1	-9	-19	-21	-18	-11
	South 40° latitude	1	-7	-16	-17	-15	-8
Indiana		-1	-7	-16	-18	-16	-9
Iowa		-2	-13	-23	-26	-22	-16
Kansas		-2	-11	-15	-19	-14	-13
Kentucky		1	-6	-13	-14	-11	-6
Louisiana		5	-1	-3	-4	-2	1
Maine		-3	-10	-23	-26	-26	-18
Maryland		2	-3	-10	-12	-10	-4
Massachusetts		-2	-7	-16	-18	-17	-10
Michigan		-2	-11	-20	-23	-23	-18
Minnesota		-4	-18	-30	-34	-31	-24
Mississippi		3	-3	-6	-6	-4	-1
Missouri		1	-7	-14	-16	-13	-8
Montana		-7	-18	-24	-30	-24	-21
Nebraska		-3	-13	-18	-22	-19	-13
Nevada	North 38° latitude	-7	-14	-18	-22	-18	-13
	South 38° latitude	8	0	-3	-4	-2	1
New Hampshire		-3	-8	-18	-21	-21	-12
New Jersey		2	-3	-11	-12	-11	-6
New Mexico	North 34° latitude	-2	-11	-14	-17	-14	-11
	South 34° latitude	4	-4	-8	-11	-7	-3
New York	North 42° latitude	-3	-8	-21	-24	-24	-16
	South 42° latitude	-1	-5	-14	-16	-15	-9
North Carolina		-1	-7	-10	-11	-9	-5
North Dakota		-4	-20	-27	-31	-29	-22
Ohio		-1	-7	-16	-17	-15	-9
Oklahoma		1	-8	-12	-13	-8	-7
Oregon	East 122° long	-6	-11	-14	-19	-14	-9
	West 122° long	0	-4	-5	-7	-4	-3
Pennsylvania	North 41° latitude	-3	-8	-19	-20	-21	-15
	South 41° latitude	0	-6	-13	-14	-14	-8
Rhode Island		1	-3	-12	-13	-13	-7
South Carolina		5	-1	-5	-5	-3	-2
South Dakota		-4	-14	-24	-27	-24	-18
Tennessee		1	-5	-9	-11	-9	-4
Texas	North 31° latitude	3	-6	-9	-13	-9	-7
	South 31° latitude	9	2	-2	-3	-1	2
Utah		-2	-11	-14	-18	-14	-8
Vermont		-3	-8	-20	-23	-24	-15
Virginia		2	-3	-9	-11	-9	-4
Washington	East 122° long	-2	-8	-11	-18	-11	-8
	West 122° long	0	-3	-3	-7	-4	-3
West Virginia		-3	-8	-15	-16	-14	-9
Wisconsin		-3	-14	-24	-28	-24	-18
Wyoming		-4	-15	-18	-26	-19	-16

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X6. MICROBIAL CONTAMINATION

X6.1 Uncontrolled microbial contamination in fuel systems can cause or contribute to a variety of problems, including increased corrosivity and decreased stability, filterability, and caloric value. Microbial processes in fuel systems can also cause or contribute to system damage.

X6.2 Because the microbes contributing to the problems listed in X6.1 are not necessarily present in the fuel itself, no microbial quality criterion for fuels is recommended. However, it is important that personnel responsible for fuel quality understand how uncontrolled microbial contamination can affect fuel quality.

X6.3 Guide D6469 provides personnel with limited microbiological background an understanding of the symptoms, occurrences, and consequences of microbial contamination. Guide D6469 also suggests means for detecting and controlling microbial contamination in fuels and fuel systems. Good housekeeping, especially keeping fuel dry, is critical.

X7. GUIDANCE ON EVALUATION OF NEW MATERIALS FOR #1D AND #2D GRADES OF DIESEL FUELS

X7.1 The purpose of this Appendix is to give some general guidance from Subcommittee D02.E0 on evaluation of new materials for blends in or replacements for Specification D975, Grades #1-D and #2-D type fuels.

X7.2 ASTM International is an organization made up of volunteers and open to all stakeholders and interested entities including users of fuels, producers of fuels, and general interests, including members of the public, and governmental and nongovernmental organizations. Technical committees and subcommittees of ASTM International do not certify, approve, reject, or endorse specific fuels. Rather, ASTM International Committee D02 on Petroleum Products and Lubricants and its Subcommittee D02.E0 on Burner, Diesel, Non-Aviation Gas Turbine, and Marine Fuels develop fuel specifications and with other subcommittees, test methods for diesel fuels. These fuel specifications and test methods provide minimum requirements for properties of fuels covered by these documents in commerce and address the concerns of stakeholders, including that fuels perform appropriately in the specified application.

X7.3 Historically, diesel fuel has been hydrocarbon molecules refined from petroleum. As a result, Specification D975 has evolved to define performance requirements (and tests to determine if those requirements were met) for diesel (compression ignition) engine fuels composed of conventional hydrocarbon oils refined from petroleum. Because the specification evolved to describe this type of fuel, some of the properties necessary for use in a compression ignition engine which are inherent in petroleum derived oils may not be addressed in Specification D975.

X7.4 Specification D975, however, does not require that fuels be derived from petroleum. Section 7.1reads, "The grades of diesel fuel oils herein specified shall be hydrocarbon oils, except as provided in 7.3, with the addition of chemicals to enhance performance, if required, conforming to the detailed requirements shown in Table 1." "Hydrocarbon oils, except as provided in 7.3," provides a path to include other fuels and blendstocks appropriate for inclusion in Specification D975. To date, this path has been used by biodiesel, which is not refined from petroleum and is not hydrocarbon oil.

X7.5 It should be noted that fuel specifications other than Specification D975 have been and are being developed for fuel for compression ignition engines. Specification D6751 sets specifications for fatty acid alkyl esters (B100) to be used as a blend stock. Specification D7467 sets specifications for diesel blends containing biodiesel in the range of 6% to 20%. Other new specifications are currently under development. Some new materials may require additional new standard specifications if they are significantly different than current diesel fuels and require different parameters to be controlled or different test methods to properly measure required parameters.

X7.6 Because the composition and properties of new fuels may vary, the particular path to a specification for a new fuel may vary. Some current alternative fuels are similar to traditional petroleum-refined diesel fuel while others are chemically and physically different. Future fuels may vary even more.

X7.7 Three areas for consideration when reviewing new fuels alignment with existing standards or developing new standards are: test methods, chemical and physical limitations of fuels in existing specifications, and chemical and physical limitations appropriate for new fuels. The test methods that have been developed for existing compression ignition engine fuels may or may not be appropriate for a new fuel. Guidance on materials used to develop a test method, and it's applicability, can generally be found in a test method's scope and precision statements. The test method may also work for other materials.

X7.8 Applicability of the test method to materials outside its scope may be established by the subcommittee responsible for the method. Also, Subcommittee D02.E0, during the specification development process, may determine that a test method is applicable for specification purposes, even if the material is not in the test method's scope. Chemical and physical limits set in existing standards may or may not be appropriate to the new fuel or components. The new material may also require chemical or physical limits that are not appropriate to fuels in existing standards. These along with other considerations may indicate the need for separate new specifications. Although each case will require a separate evaluation, logic suggests that

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the fewer chemical and physical differences there are between the new fuel and traditional petroleum-based diesel fuel, the fewer differences in test methods and chemical or physical limits will be needed.

X7.9 If the proponent of the new fuel desires to move forward via the consensus process as described by ASTM bylaws and as implemented in Committee D02, then the proponent or a task force including the fuel manufacturer or proponent will bring forward ballot revisions to Specification D975 or a new specification appropriate for use of the new fuel or blendstock. Because D02 specifications are established based on technical data, such data should exist before the specification process moves forward. If such data does not exist, it needs to be developed.

X7.10 This guidance is not all-encompassing and cannot replace the judgment and process of a task force and subcommittee charged with evaluating a new fuel or blendstock. However it may give some guidance to proponents or fuel manufacturers who are considering participation in ASTM Committee D02 and its subcommittees to promote the inclusion of their new fuel or blendstock in ASTM standards.

SUMMARY OF CHANGES

Subcommittee D02.E0 has identified the location of selected changes to this standard since the last issue (D975–12) that may impact the use of this standard. (Approved Nov. 1, 2012.)

(1) Revised definition of hydrocarbon oil.

Subcommittee D02.E0 has identified the location of selected changes to this standard since the last issue (D975–11b) that may impact the use of this standard. (Approved June 1, 2012.)

(1) Added Appendix X7.
(2) Revised hydrocarbon oil discussion (3.2.1).
(3) Added Test Method D7345 to Referenced Documents and 5.1.6.

Subcommittee D02.E0 has identified the location of selected changes to this standard since the last issue (D975–11a) that may impact the use of this standard. (Approved Dec. 1, 2011.)

(1) Added Test Method D7619 to the Referenced Documents and standard text.
(2) Added new X3.6.6.

Subcommittee D02.E0 has identified the location of selected changes to this standard since the last issue (D975–11) that may impact the use of this standard. (Approved Nov. 15, 2011.)

(1) Added definition for hydrocarbon oil (3.2.1).
(2) Added Note 5.
(3) Updated 7.1.
(4) Added new Footnote B to Table 1.

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March 7, 2014

Mr. Charlie Poster
Assistant Commissioner
Minnesota Department of Agriculture
625 Robert Street N
St. Paul, MN 55155-2538
Via e:mail: Charlie.poster@state.mn.us

Dear Mr. Poster:

I am the fuel quality enforcement manager for the National Biodiesel Board, and have served the NBB in that capacity since 2009. In our phone call February 27, you asked if data were available regarding what percentage of finished fuels in the state of Illinois was B10 and above. Per your request, I am providing details of data collected by the Illinois Bureau of Weights and Measures between June 23, 2011 and July 9, 2013 on samples collected from retail fuel stations that were measured for biodiesel content by the Bureau.

The original purpose of the data collection was to determine what percentage of fuel retail stations in Illinois were selling biodiesel blends, and at what blend percentage level they were selling it. This project was developed through a partnership between the Illinois Department of Agriculture and the Illinois Soybean Association in an attempt to quantify the cost of the biodiesel tax incentive program to taxpayers in Illinois, and to determine if a return on the state's investment was being realized. Recognizing the direct and indirect jobs created, growth of truck stops and increase in diesel sales, the state legislature extended the tax incentive to December 31, 2018.

During this timeframe, a total of 1123 samples were analyzed. Of those samples, the number that contained blend levels of 10% or above was 612, or 55%. Of the samples collected, 370 were analyzed with the full ASTM D7371 method; 633 on the Wilks InfraCal, a portable infrared biodiesel blend analyzer, and 120 samples were analyzed using both methods. To accommodate for the precision of the method (D7371), samples that registered at 9% were included (the margin of error for the method is 1%). There were no samples over 21%, so the margin of error was used for the entire sample.

At the same time period, the Illinois Bureau of Weights and Measures received no more additional diesel fuel complaints than average, and none specifically related to biodiesel. The annual on-highway diesel sales in Illinois ranked fourth in the nation in 2012 (behind California, Ohio and Pennsylvania), with 1.387 billion gallons. Fifty-five percent of that amount is approximately 763 million gallons of blended fuel per year. If the average diesel engine travels 10 miles per gallon, vehicles have traveled 7.63 billion miles on

blends of biodiesel of ten percent or greater each year – or a total of more than 15 billion miles during the same two-year period when the data set was collected.

If I can be of further assistance, do not hesitate to contact me.

Sincerely,

Rebecca Richardson

Rebecca A. Richardson
NBB Fuel Quality Enforcement Manager

ED_000313_O365_00001126

BIODIESEL !!!!!!OEM!Support!

OEMs!Supporting!B100!	OEMs!Supporting!B20!	OEMs!Supporting!B5!!
Case!IH!!(2007)!	Arctic!Cat!!(2006)!	Audi!*!!! (Allow'up'to'B20'in'IL'in'2009L2013' models)'
Deutz!AG!(2012)!	Buhler!!(2007)!	BMW!
Fairbanks!Morse!!(2007)!	Caterpillar!!(All'model'years)!	Hustler!Turf!Equipment!
New!Holland!!(2007)!	Chrysler'–'Ram!(2007)!&!Jeep!(2013)'	Mercedes!Benz!*!!! (Allow'up'to'B20'in'IL'since'Nov.'2013)!
!	Cummins!!(2002)!	Mitsubishi!Fuso!*!
'	Daimler!Trucks!K!Including:!!!(2012)!	PACCAR!!K!Including:!
'	!!!!K!Detroit!Diesel!'	!!!!K!Kenworth!
'	!!!!K!Freightliner/!"!Custom!Chassis!	!!!!K!Peterbilt!
'	!!!!K!Thomas!Built!Buses!	Volkswagen!*!! (Allow'up'to'B20'in'IL'in'2009L2013' models)!
'	!!!!K!Western!Star!	!
'	Ferris!!(2011)!	*!=!Actively!Researching!B20!
'	Ford''''(2011)'	!
'	GMC!&!Chevrolet!!!! (2011'all;'SEO'available'since'2007)'	!
'	HDT!USA!Motorcycles!!(2008)!	!
'	Hino!Trucks!!(2011)!	Biodiesel!Position!Not!Yet!Announced!
'	Navistar!!K!International!/ !MaxxForce!! (2007)!	JCB!
'	IC!Bus!!(2007)!	Mahindra!
'	Isuzu!Commercial!Trucks!(2011)!	Mazda!
'	John!Deere!!(2004)!	Porsche!
'	Kubota!!(2006)!	Nissan!
'	Mack!!(EPA'2007'&'EPA'2010'models)!	!
'	Monaco!RV!!(2007)!	!
'	Perkins!!(2008)!	!
'	Tomcar!!(2008)!	!
'	Toro!'(2008;'SEO'kits'for'<2008)!	!
'	Volvo!Trucks!!(EPA'2010'models)!	!
'	Workhorse!!(2007)!	!
'	Yanmar!!(2011)!	!

∞ Dates'indicated'in'(')'above'describe'when'the'OEM'first'approved'B20'or'higher'biodiesel'blends

∞ **All!major!OEMs!producing!diesel!vehicles!for!the!U.S.!market!support!at!least!B5!and!lower!blends,!and!over!78%!of!those! manufacturers!now!support!B20!or!higher!biodiesel!blends!in!at!least!some!of!their!equipment,!including!nearly!85%!of!the! medium!&!heavy!duty!truck!OEMs.**''The'biodiesel'component'must'meet'ASTM'D6751,'the'approved'standard'for'pure' biodiesel,'and'the'B20'blends'must'meet'ASTM'D7467'specifications.''Many'OEMs'also'recommend'the'use'of'a'BQ9000' supplier.'

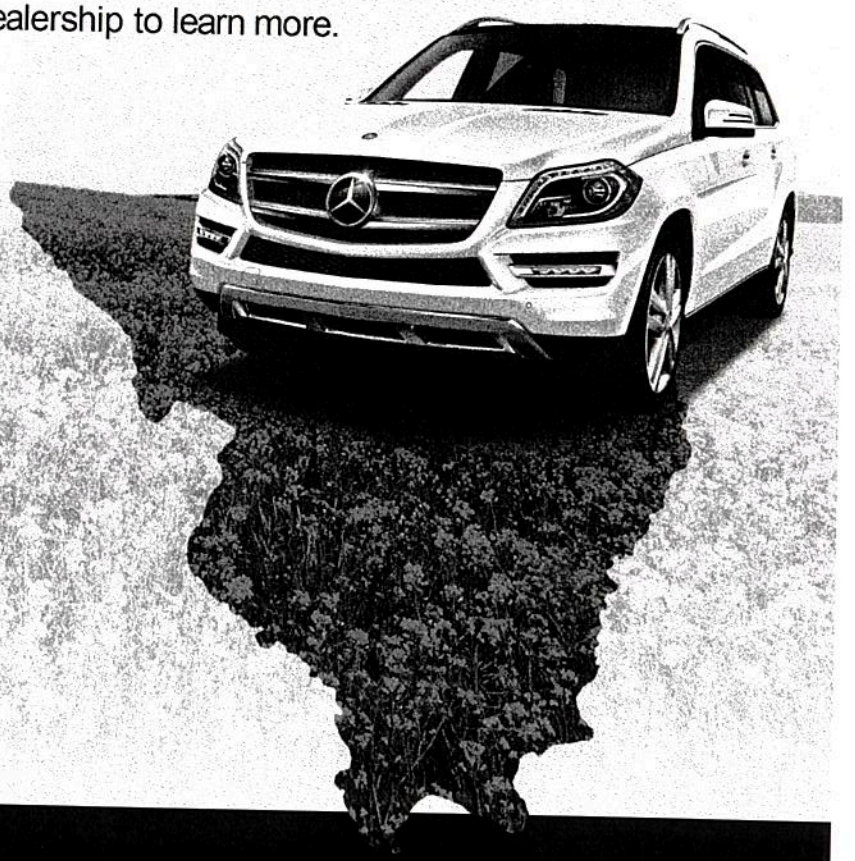
∞ For'a'complete'detailed'listing'of'**OEM!position!statements!on!biodiesel**'visit:'www.biodiesel.org/using!biodiesel/oemK information.''

December'2013'

ED_000313_O365_00001128

You can own and drive a Mercedes-Benz Diesel in the state of *Illinois*

Visit your local Mercedes-Benz dealership to learn more.



Should you have any questions or concerns, please contact your Mercedes-Benz dealer or the Customer Assistance Center at 1-800-FOR-MERCEDES (1-800-367-6372).

Please keep this pamphlet with your Warranty Booklet for future reference.

We hope you are enjoying the exceptional performance and fuel economy of your Mercedes-Benz diesel vehicle and wish you many miles of driving pleasure. Thank you for driving a Mercedes-Benz.

Mercedes-Benz USA, LLC
One Mercedes Drive, Montvale, NJ 07645
1-800-FOR-MERCEDES
MBUSA.com

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A Daimler Company

PSMKG-13-BIODIESEL (10/13)

Mercedes-Benz

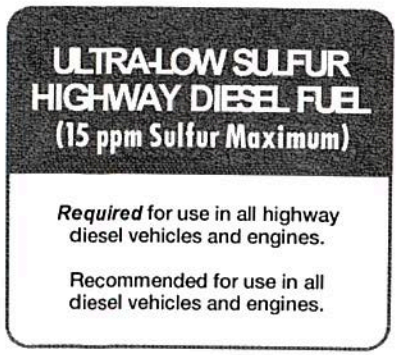
Congratulations on your selection of one of the most advanced diesel automobiles in the world.

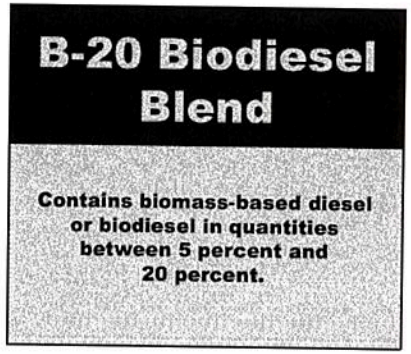
Your Mercedes-Benz was developed by a company steeped in engineering tradition, and we continuously monitor market conditions to help you foster a long-lasting and gratifying experience with your vehicle. We have found one such development that warrants your attention.

Some states offer certain incentives to blend biodiesel into highway diesel fuel. Biodiesel is produced from various sources such as vegetable oil and used cooking oil, which is processed with methanol to be used as a bio substitute for conventional diesel fuel. As biodiesel is a domestic product it improves energy independence and supports the US economy.

The percentage of biodiesel in highway diesel fuel varies throughout the United States, particularly in Illinois. **Diesel fuel with biodiesel contents up to 5% will generally be labeled "Ultra Low Sulfur Diesel" or ULSD, while fuels with biodiesel contents between 5% and 20% will generally be labeled "B20".**

The fuel station dispenser labels are shown below:





Continuous use of B20 fuel can lead to fuel filter clogging and injector deposits, and can cause the engine oil level to rise due to unburned fuel washing into the oil pan. A clogged fuel filter as well as injector deposits can cause engine performance degradation while increased engine oil levels due to dilution by unburned fuel can cause engine mechanical damage.

With these risks in mind, here are some things you can do to help mitigate the effects of B20 fuel:

- Fill up with ULSD **(B5 or less)** whenever possible, from a name brand fuel station.
- Regularly monitor your engine oil level if you use B20 fuel on a regular basis.
- Strictly follow the oil change intervals quoted in the instrument cluster and within your maintenance booklet, and **use ONLY engine oils and filters approved by Mercedes-Benz for use in your vehicle**
- If you do not plan to drive your vehicle for several weeks, fill your vehicle's fuel tank in advance with ULSD fuel.

ED_000313_O365_00001128

Volkswagen of America, Inc.
3800 Hamlin Road
Auburn Hills, MI 48326

<MONTH YEAR>

<CUSTOMER NAME>
<CUSTOMER ADDRESS>
<CUSTOMER CITY STATE ZIPCODE>

Vehicle Identification Number (VIN): <VIN>

Subject: 2009-2013 Model Year Volkswagen TDI® Clean Diesel Vehicles Registered in Illinois Using Biodiesel Blend Fuels

Dear Volkswagen TDI Clean Diesel Owner,

As a valued Volkswagen customer, your satisfaction is our utmost priority. Because we support the development and use of renewable fuels (such as biodiesel fuel blends) we are writing to customers who have Volkswagen TDI® Clean Diesel engine vehicles registered in the State of Illinois in order to share some important information about using biodiesel fuel blends in these vehicles.

What is biodiesel?

Biodiesel is a domestically produced, clean-burning and renewable partial substitute for conventional (petroleum) diesel fuel.

Why is it important for me to know about biodiesel fuel blends?

Your vehicle was originally designed to run on "ULSD" - Ultra Low Sulfur Diesel No. 2 – fuel that complies with ASTM D-975 specifications and permits up to a maximum blend of 5% biodiesel (B5).

Due to Illinois state tax incentives for biofuels, biodiesel blends of B5 or less may not be available in Illinois. *However, we want to assure you that Volkswagen will continue to honor the terms and conditions of the Volkswagen Limited Warranties that came with your vehicle.*

Biodiesel blends (up to B20) may be used in your Illinois-registered TDI® Clean Diesel vehicle; however please be aware that biodiesel has characteristics that are different from other kinds of fuel, especially petroleum-based fuels.

How does biodiesel differ from ULSD diesel fuel?

Biodiesel can attract water and also deteriorate with age. Small amounts of biodiesel can get into the engine oil, but unlike petroleum diesel, it does not evaporate over time. This can cause the oil level in the engine to rise and can affect the quality of the oil.

When I use biodiesel blends in my Illinois-registered Volkswagen TDI® Clean Diesel vehicle, what should I remember?

- Routinely check the engine oil level. A good time to do this is when you refuel, especially if you regularly do a lot of short distance or stop-and-go driving. This will help you see if the engine oil level is getting **higher**. (A rising oil level beyond the maximum indicator means an oil change is needed due to the dilution of the oil in the system; a potential characteristic of biodiesel use.) See your Owner's Manual for additional information on checking the engine oil level in your vehicle.
- If you ever notice that the engine oil level has risen or is above the maximum indicator, contact your authorized Volkswagen dealer or Volkswagen Customer CARE to schedule an oil change – regardless of the time or mileage that has elapsed since you last had an oil change performed.
- Continue to follow the oil change intervals found in the maintenance booklet that came with your vehicle, and use only engine oil that expressly complies with Volkswagen quality standard VW 507 00.
- Refuel only at trusted, commercial fueling stations that are located near main highways. These stations are more likely to have "fresh" biodiesel fuels that have not aged significantly.
- When your vehicle will be in storage (or not driven) for several weeks or months, please completely fill the fuel tank. If possible, fill the tank with Ultra Low Sulfur Diesel fuel (ASTM D975 standard Grade No. 2 D S15).

Can we assist you further?

If you have additional questions about your Illinois-registered TDI® Clean Diesel vehicle, please call or write to us at:

Volkswagen of America, Inc.
Attn: Customer CARE
3800 Hamlin Road, Auburn Hills, MI 48326
1-800-444-8982

Please keep this letter with your Warranty booklet for future reference, and deliver it to any new owner, along with the owner's manual.

We hope you are enjoying the exceptional performance and fuel economy of your TDI® Clean Diesel vehicle, and we wish you many more miles of driving pleasure. Thank you for driving a Volkswagen!

Sincerely,

Volkswagen Service & Quality

USA VWBioD IL

Mercedes-Benz

October 31, 2013

Mercedes-Benz USA, LLC
A Daimler Company

Mr. Don Onwiler
Executive Director
National Conference on Weights and Measures
1135 M Street, Suite 110 / Lincoln, Nebraska 68508

Dear Mr. Onwiler:

It has come to our attention that certain producers are inappropriately claiming compliance with the ASTM D975 Standard Specification for Diesel Fuel Oils. Recent warranty data reveals component failures due to the presence of fuel constituents not supported by the D975 specification.

This memo provides a brief explanation of the background of the ASTM D975 standard, the recent changes that have been implemented to it, and a clarification of the Mercedes-Benz and other OEM fuel injection supplier and trade association positions on materials which do not fall under the D975 standard.

The ASTM D975 specification, developed over the last 50 years, is based on the use of crude petroleum refined in conventional petroleum refineries. Fuels produced in this manner have certain inherent properties that make them suitable for use in diesel engines including, but not limited to: BTU content, fuel stability, and bulk modules of elasticity. Such properties are not controlled or measured in the ASTM D975 fuel specification. It is the combination of meeting the ASTM D975 fuel specification–and the inherent properties of fuel produced from traditional petroleum refineries–that provides a "fit for purpose" fuel for diesel engines.

Mercedes-Benz USA, in conjunction with General Motors Company, Truck and Engine Manufacturers Association (EMA), Robert Bosch GmbH and other stakeholders support the development of renewable fuels. These companies are actively working with the fuels industry and regulators to ensure these new fuels have appropriate specifications and quality controls. Such safeguards ensure that the renewable fuels will provide the performance customers expect from their vehicles, like those equipped with BlueTEC clean diesel technology. The first step in achieving this goal is the development and approval of ASTM consensus standards for these new fuels and additives.

Currently, the predominant new fuel for diesel engines is biodiesel, also known in the US as FAME (fatty acid methyl ester). The biodiesel industry has worked with petroleum and OEM stakeholders at ASTM to:

- secure ASTM standards for B100 (ASTM D6751 biodiesel-blendstock) used in blending with diesel fuel
- modify ASTM D975 to include up to 5% biodiesel meeting D6751
- develop a separate stand-alone standard for B6-B20 blends, ASTM D7467

The efforts of the biodiesel industry to work with OEMs, fuel refiners and fuel marketers to secure appropriate ASTM specifications serve as a model for other new fuels.

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Phone (201) 573-0600
Fax (201) 573-0117
www.MBUSA.com

As new fuels and components have come into the market, some unscrupulous marketers have begun blending non-petroleum and non-hydrocarbon materials into petroleum-based diesel fuel, claiming that the finished fuel meets the D975 standard. Many of these new materials have not been well studied or tested to ensure they will provide a "fit for purpose" fuel. Some of these materials, such as alcohols, ethers, water emulsions, and raw vegetable oils or fats, are known to promote fuel injection and other engine concerns. It is important to note that any resultant damage associated with their use will not be covered by the Mercedes-Benz or other OEM New Vehicle Limited warranties. Consequently, ASTM modified the D975 standard in 2011 to more clearly specify which constituents are covered by ASTM D975 and which will need further study prior to D975 adoption via the ASTM consensus balloting process. The present revision of D975 includes a definition of the term 'hydrocarbon oil' to more clearly describe what the specification pertains to, both from a historic and current viewpoint (see ASTM D975 section 3.2 Definitions of Terms Specific to this Standard, available at http://www.astm.org/search/site-search.html?query=D975&cartname=mystore).

The materials noted above, such as alcohols, ethers, water emulsions, and raw vegetable oils or fats are not hydrocarbons and do not fall under the ASTM D975 standard unless they have been specifically balloted into the standard. Again, the leading example here is biodiesel (which is an ester, not a hydrocarbon), now permitted in blends up to 5% biodiesel, which meets its ASTM D6751 B100 blendstock standard under ASTM D975 through its incorporation under Section 7.3 of the standard.

This background is important when considering that certain companies are blending into base petroleum diesel fuel, oxygenated materials in levels up to 5% and claiming they 'meet D975' even though ASTM has incorporated the definitions above to strictly prohibit such materials from being considered D975 compliant fuel. We understand these companies are claiming they are 'additives' which are mentioned in D975 Note 5 as generally included in finished diesel fuel to improve performance properties (e.g. Cetane Number, lubricity, etc.).

Diesel fuel additives are typically added in extremely small levels (commonly between 3 -200 ppm). Such additive levels are considered beneficial and are supported by OEMs in general when professionally administered prior to retail sale. While ASTM does not specifically limit the amount of allowable additives, Mercedes-Benz *et al.* maintain that the maximum allowable additive concentration in D975 diesel fuel is 5000 ppm or 0.5% v/v.

Furthermore, the Truck and Engine Manufacturers Association issued a position statement in July 2012 stating that the use of unprocessed fats, greases or oils can reduce engine life and result in increased maintenance costs and should therefore be avoided. Referenced in that EMA guidance letter is the US Department of Energy's "Biodiesel Handling and Use Guide, 4th Edition" which advises that "raw or refined plant oil, or recycled greases that have not been processed into biodiesel, are not biodiesel and should be avoided." Similarly, the Diesel Fuel Injection Equipment Manufacturers, consisting of Bosch, Continental, Delphi, Denso, and Stanadyne issued "Common Position Statement 2012", available at http://www.globaldenso.com/en/topics/files/120730common_position_paper.pdf, which explicitly states that "the FIE manufacturers note that their high pressure fuel injection equipment is not designed to run on unesterified plant oil...".

Thus, in our view, fuels containing oxygenated materials other than 5% biodiesel, or additives in excess of 5000 ppm, do not meet ASTM D975. To reiterate, damage induced by fuel containing these products would not be covered by the Mercedes-Benz New Vehicle Limited Warranty or other OEM vehicle warranties.

Clean diesel technology is an integral part of the Daimler GHG Compliance Plan and customer acceptance of clean diesel technology is critical to the success of C02 reduction. We are extremely concerned that companies which produce or blend in low quality, non-ASTM covered alternative, renewable or oxygenated materials into US diesel fuel have caused and will cause both short- and long-term problems in these vehicles, adversely affecting the customer perception and acceptance of clean diesel technology in the US.

We encourage your support in enforcing the ASTM D975 specification as it was intended, and welcome the opportunity to discuss this with you and assist in this effort.

If you have any questions, please feel free to contact me or William Woebkenberg, Fuels Technical and Regulatory Affairs, Mercedes-Benz Research & Development North America.

Sincerely,

R. Thomas Brunner
Department Manager,
Vehicle Compliance and Analysis
Product Technical Support

Shaun Roopnarine
Environmental Compliance Engineer
Vehicle Compliance and Analysis

OEM Warranty Statements and Use of Biodiesel Blends over 5% (B5)

As the biodiesel industry grows and thrives, the National Biodiesel Board is receiving an increasing amount of inquiries regarding the use of blends over 5% biodiesel. The purpose of this document is to more fully explain the current status of NBB's efforts with the diesel engine and equipment community and to provide guidance on the use of blends over B5.

All engine and vehicle manufacturers provide a material and workmanship warranty on the products they manufacture. Such warranties do not cover damage or problems caused by external factors or elements they don't produce or control, such as the type of fuel or additives used in the engine. Thus, if an engine experiences a failure that is caused by a fuel or a fuel additive – no matter if the fuel or additive is biodiesel, regular petroleum diesel, or an aftermarket additive -the damage generally will not be covered by the OEM's equipment and workmanship warranty.

Real world examples with diesel that would not be covered by warranty are fuel pump or injector damage caused by water, dirt contamination, or poor lubricity, as well clogged filters caused by microbial contamination in diesel. Such issues are normally the responsibility of the fuel supplier and not the engine manufacturer and therefore should be covered by the fuel supplier's general liability insurance unless otherwise stated.

Most OEM dealers and customer service departments currently tell their customers the use of up to 5% biodiesel (B5) is acceptable, with the requirement the pure biodiesel fuel adhere to the quality standards specified by American Society of Testing and Materials standard (ASTM D 6751) prior to blending. Many OEM's are also recommending biodiesel and biodiesel blends only be purchased from BQ-9000 certified companies. There are some OEM's who tell their customers biodiesel blends up to B20 are acceptable, while others say anything up to B100 is acceptable. There can even be dramatic differences in the OEM advice on using biodiesel blends within different departments or dealers within the same company or brand. These differences in warranty position and customer advice on biodiesel blends are related to the biodiesel knowledge level of the company or exact person contacted, the status of ASTM standards for biodiesel and biodiesel blends, and general questions about fuel quality and fuel stability.

The National Biodiesel Board (NBB) and the diesel engine, fuel injection, and vehicle companies have formed the B20 Fleet Evaluation Team (B20 FET) to develop an informed, fact-based position on the use of up to a 20% biodiesel blend in diesel engine applications in the U.S. The results will be based on a stakeholder assessment of actual fleet experience and controlled validation tests. The B20 FET has been active for over two years, and has identified a list of recommendations for users who wish to use B20 in their existing fleet. This list of recommendations titled, **"Technical Recommendations for B20 Fleet Use Based on Existing Data"** and dated June 2005 describes the specific advice for users who wish to use blends of B20. This would also apply to blends over B5 and below B20, such as B11 which is a popular blend in Illinois due to state tax

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considerations there.

As can be seen from the participant listing of the B20 FET members listed at the end of the Technical Recommendations, all the major diesel equipment companies are working with NBB on this effort. While these B20 recommendations are not intended to extend or supplant warranty limitation provided by an individual engine or equipment supplier, they represent the consensus of the members of the B20 FET. The specific position and warranty statements provided to NBB for most of the major equipment companies is available on the NBB web site at: http://nbb.org/resources/fuelfactsheets. In 2003 the National Biodiesel Board commissioned a survey of 53 fleet operators representing 50,821 diesel powered vehicles. Among biodiesel users surveyed, 96% of the respondents said that they would recommend biodiesel to other fleets. (The lone holdout cited cost, not performance as the reason for not recommending biodiesel at that time). 88% of those biodiesel users were operating on B20 or higher blends.

With biodiesel that meets the ASTM D 6751 specification, there have been over 50 million miles of successful, problem-free, real-world operation with B20 blends in a wide variety of engines, climates, and applications. The steps taken by the biodiesel industry to work with the engine companies on approving and implementing ASTM D 6751 provides confidence to users and engine manufacturers that their B20 experiences will be positive and trouble-free.

Through cooperative programs currently underway with the US Department of Energy's National Renewable Energy Laboratory, the US Department of Agriculture's National Biodiesel Education Program, and the major OEM's, the NBB is actively working to provide the information, data, and quality assurances that will enable all diesel equipment companies to increase the blend level they recommend to their customers to B20. These activities include adding a stability parameter and other changes to the pure biodiesel specification, approving ASTM specifications for the properties of the finished blends of biodiesel up to B5 and B20, implementation of the BQ9000 quality program and biodiesel blend supply companies, sharing more quantitative data with the OEM's through the B20 Fleet Evaluation Team and National Biodiesel Education Program efforts, as well as testing programs on new diesel technologies for 2007/2010 model years which will provide a 90% reduction in emissions of particulate matter and NOx compared to today's levels.

Once these efforts to secure B20 support with the OEM's is complete, we anticipate there will no longer be any doubt about whether blends of B20 and lower are OK. In the meanwhile, **if you follow the "Technical Recommendations for B20 Fleet Use Based on Existing Data", you can use B20 trouble free RIGHT NOW and help to clean up our environment while providing agricultural and manufacturing jobs and helping to eliminate our dependence on foreign sources of imported oil. Use B20—help start "The Drive to Independence™."**

Technical Recommendations for B20 Fleet Use Based on Existing Data
B20 Fleet Evaluation Team: June 2005

Biodiesel is the pure, or 100 percent, biodiesel fuel. It is referred to as B100 or "neat" biodiesel.

A biodiesel blend is pure biodiesel blended with petrodiesel. Biodiesel blends are referred to as BXX. The XX indicates the amount of biodiesel in the blend (i.e., a B20 blend is 20 percent by volume biodiesel and 80 percent by volume petrodiesel).

Ensure the biodiesel meets the ASTM specification for pure biodiesel (ASTM D 6751) before blending with petrodiesel. Purchase biodiesel and biodiesel blends only from companies that have been registered under the BQ-9000 fuel quality program.

Ensure the B20 blend meets properties for ASTM D 975, Standard Specification for Diesel Fuel Oils or the ASTM specification for B20 once it is approved.

Ensure your B20 supplier provides a homogenous product.

Avoid long term storage of B20 to prevent degradation. Biodiesel should be used within six months.

Prior to transitioning to B20, it is recommended that tanks be cleaned and free from sediment and water. Check for water and drain regularly if needed. Monitor for microbial growth and treat with biocides as recommended by the biocide manufacturer. See the NREL Biodiesel Storage and Handling Guidelines for further information http://www.nrel.gov/vehiclesandfuels/npbf/pubs_biodiesel.html

Fuel filters on the vehicles and in the delivery system may need to be changed more frequently upon initial B20 use. Biodiesel and biodiesel blends have excellent cleaning properties. The use of B20 can dissolve sediments in the fuel system and result in the need to change filters more frequently when first using biodiesel until the whole system has been cleaned of the deposits left by the petrodiesel.

Be aware of B20's cold weather properties and take appropriate precautions. When operating in winter climates, use winter blended diesel fuel. If B20 is to be used in winter months, make sure the B20 cloud point is adequate for the geographical region and time of year the fuel will be used.

Perform regularly scheduled maintenance as dictated by the engine operation and maintenance manual. If using B20 in seasonal operations where fuel is not used within 6 months, consider storage enhancing additives or flushing with diesel fuel prior to storage.

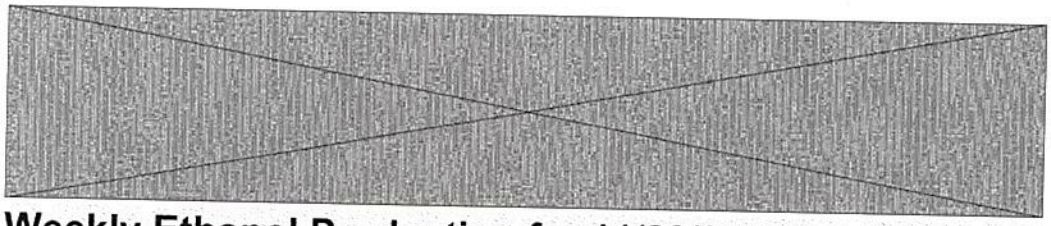
These recommendations on use of B20 are preliminary and are not provided to extend or supplant warranty limitation provided by an individual engine or equipment supplier. Use of B20 blends is solely at the discretion and risk of the customer and any harm effect caused by the use of B20 are not the responsibility of the engine or equipment maker.

B20 Fleet Evaluation Team Members

Cummins, John Deere, International Truck and Engine Corp, DaimlerChrysler, Caterpillar, Ford Motor Company, General Motors, Department of Defense, Siemens, Delphi Automotive Systems, Volkswagen, Engine Manufacturers Association, MARC-IV Consulting, ASG Renaissance, Bosch, FleetGuard, NREL, BMW of North America, Mack Trucks, Stanadyne Automotive Corporation, Suncor, CNH Global, Parker-Hannifin-Racor Division, and DENSO International America.

ED_000313_O365_00001131

To: Machiele, Paul[machiele.paul@epa.gov]
From: Geoff Cooper
Sent: Wed 11/27/2013 4:32:11 PM
Subject: Weekly Ethanol Production for 11/22/2013



Weekly Ethanol Production for 11/22/2013

Good morning,

Here is the weekly ethanol production data for the week ending 11/22/2013.

According to EIA data, ethanol production averaged 927,000 barrels per day (b/d) — or 38.93 million gallons daily. That is up 23,000 b/d from the week before and tied for the highest output rate of the year. The four-week average for ethanol production stood at 915,000 b/d for an annualized rate of 14.03 billion gallons.

Stocks of ethanol stood at 15.0 million barrels. That is a 0.4% decrease from last week and the lowest since EIA began reporting weekly data.

Imports of ethanol were zero b/d for the eighth straight week.

Gasoline demand for the week averaged 374.2 million gallons daily.

Expressed as a percentage of daily gasoline demand, daily ethanol production was 10.41%. That is the highest percentage since June 2012.

On the co-products side, ethanol producers were using 14.056 million bushels of corn to produce ethanol and 103,456 metric tons of livestock feed, 92,232 metric tons of which were distillers grains. The rest is comprised of corn gluten feed and corn gluten meal. Additionally, ethanol producers were providing 4.83 million pounds of corn oil daily.

If you have any questions, please let us know.

Contact:
Dawn Moore
Communications Director
Renewable Fuels Association
(202) 289-3835
dmoore@ethanolrfa.org

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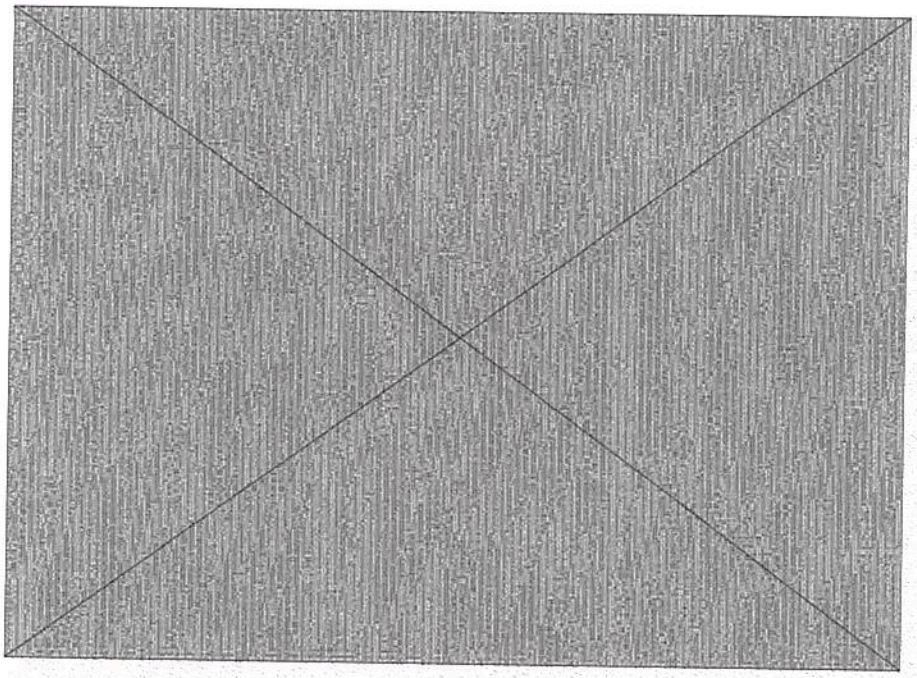
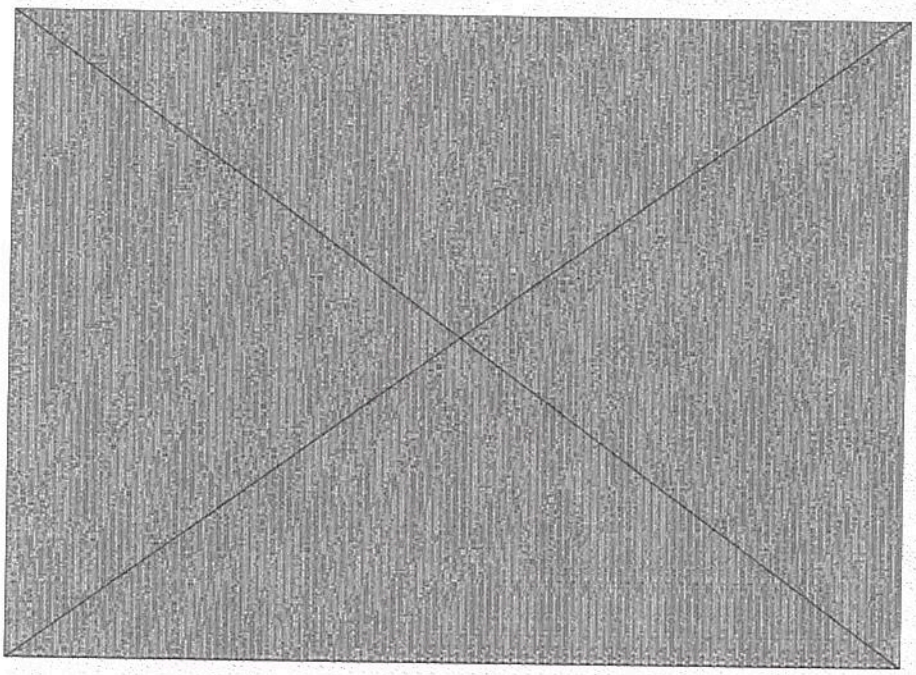


Enlarge this chart.



Enlarge this chart.

Contact:
Dawn Moore
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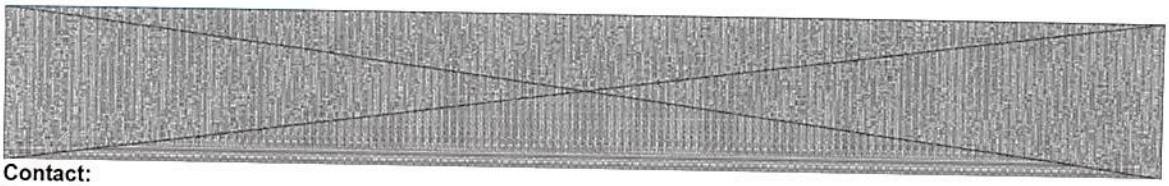

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